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PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

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Municipal Engineering

VOLUME XII. APRIL, EIGHTEEN NINETY-SEVEN. NUMBER 4.

MAINTENANCE OF WOOD PAVEMENT IN EUROPEAN CITIES.

By Robert Grimshaw, C. E.

For a time the appearance of wood pavement is quite good; but there comes a day when by reason of the unequal density of the blocks and their permeability, their condition and appearance rapidly deteriorate. Holes and shallow sunken places appear, requiring the withdrawal of one or more blocks and their replacement by new. Beech wood in particular wears round on the edges, as stone blocks do. But the setting of new blocks causes renewed trouble, as they project, either at once or very soon, above their neighbors, and the pavement loses its proper contour. The new blocks require beveling on the edges or planing off, to bring them down to the level of their worn neighbors; but as the new ones are harder and tougher than the old ones, they soon project again.

As regards the duration of wood pavement, German records give little that is favorable. In London, the record in 1881 was that in five years it required relaying and in ten complete renewal. Sir Joseph Bazalgette of that city reported that the duration of wood pavement in very much traveled streets was four to five years, in those with medium heavy traffic five to seven, and in those with but light traffic, eight to ten, while Stayton in 1884 gave the following figures:

Traffic Per Yard of Street Width, Per Day. Tons.	Life of Wood Pavement. Years.
....	5.
780	5.5
1100	5.5
1137	6.2
558	7.
985	7.
1236	7.
1000	7.5
985	7.58
1191	7.84
....	8.
....	9.5

From which he concluded that it was unnecessary and undesirable to give the wood blocks a height more than sufficient to last seven years, because very little such pavement after six years had a good surface. In reference to greater durability, he remarks that it can only be attained at considerable expense for repairs. A great number of new blocks must be inserted from three to five inches high, according to the amount of wear of the neighboring blocks which border them.

In Liverpool the wear of wood blocks, under a traffic of 300,000 tons yearly, was 0.6 inch. It must be remarked in this connection, (1) that the English climate is usually favorable to wood pavement; and (2) that for a given wagon capacity they use wider tires than are the custom in America.

Very thorough measurement of the wear of the blocks has been made in Paris. The reports of

Chief Engineer Allard in 1889 show extremes of wear of 1 and 17 millimeters = 0.04 and 0.68 inch per year; an average of, say, 9 mm. = 0.36 inch. According to other sources, the wear in the Avenue des Champs Elysées in the five years succeeding the laying, was (in three separate cross-sections in each case) as follows:

	Millimeters.	Inches.
(1) On the most frequented side, next the foot-pave.	8- 7- 6	0.215–10.276–0.236
(2) At a distance of 7.5 m. = 24.6 ft. from the curb.	18–18–18	0.7 – 0.7 –0.7
(3) In the center line.	29–26–27	1.14 – 1.023–1.063
(4) At 7.5 m. = 24.6 ft. from the center line.	14–15–15	0.551– 0.591–0.591

From these data, under the condition that the blocks are to be renewed when they have lost 70 to 80 mm. = 2.8 to 3.2 in. in height, the mean life of the wood pavement would be 8 years, if, too, we suppose that the regularity of wear in the later years would be the same as in the earlier years, especially with second or third-class blocks.

It is worthy of note that in Paris, the wood paving in streets with heavy traffic has proportionately longer life than in those but little used. This may be explained by the fact that the traffic is more evenly distributed over the entire street width, thus equalizing the wear, instead of having it concentrated in one or two strips; also that dirt finds less time to set in.

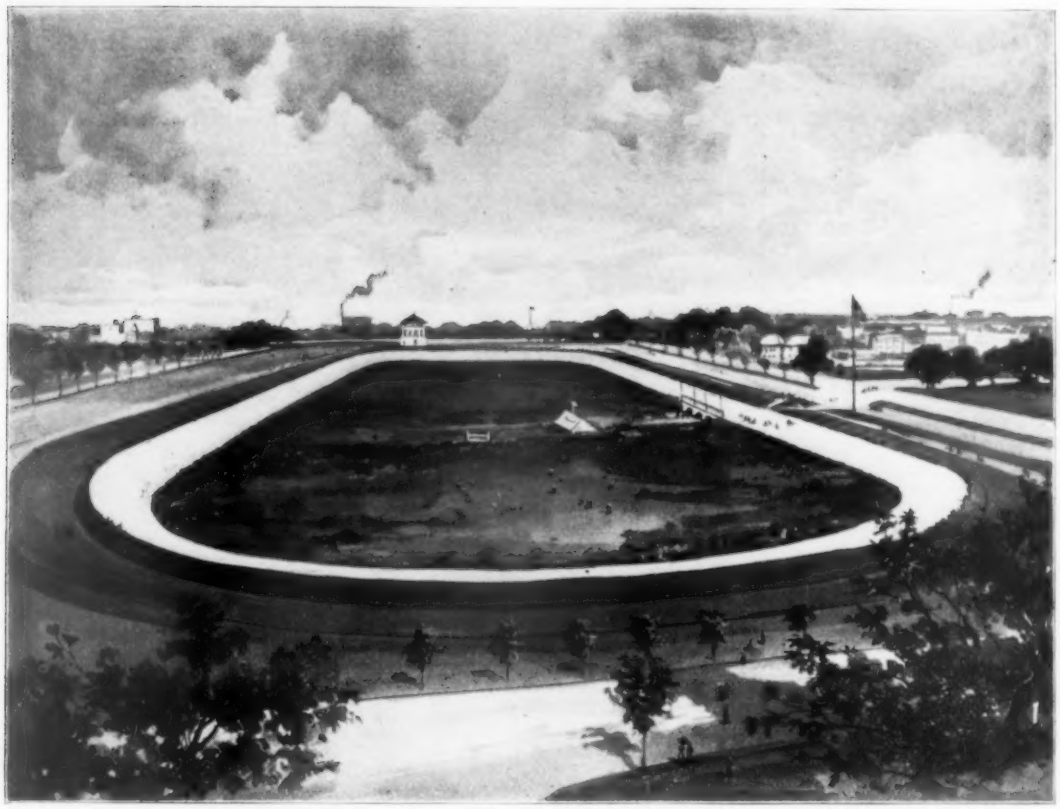
A FINE BICYCLE TRACK.

The bicyle track in Garfield Park, Chicago, is one of the finest in the country. It is located in the portion of the park which lies south of Madison street, comprising about sixty acres. The plans for the track were made by A. C. Schrader, engineer of the West Park board. The track is one-half mile in length. The tangents connecting the semicircular curves are 376.5 feet long. The radius of the inside edge of the track is 298.82 feet. The inclination of the track was computed for a speed of a mile in two minutes. The maximum banking is 4.82 feet in twenty-five feet. When traveling at the rate of thirty miles an hour the rider's wheel will be in an exactly normal position, standing at right angles to the plane of the track, thus showing absolutely no tendency to slip or wrench off the tire. The problem was very carefully studied by Mr. Schrader and has been admirably solved. The transition from curves to tangents is very carefully planned. On the west tangent the entire home stretch is thirty-five feet wide, and the east half of the track is twenty-five feet wide, while the curves broaden to thirty-five feet where they connect with the home stretch on the next tangent.

The track was made with a filling of cinders, thoroughly compacted with a ten-ton roller. The concrete surface is composed of crushed granite and Lagerdorfer German Portland cement, five inches in thickness, laid in flags containing about forty-eight superficial square feet each. The embankments sloping to the track are well sodded.

No vehicles other than bicycles are permitted on the track. Access to the athletic field enclosed by the track is provided by a subway.

The grounds are lighted by electricity and the track can be used as safely at night as during the day.



BIRD'S-EYE VIEW OF THE BICYCLE TRACK IN GARFIELD PARK, CHICAGO.

Three drinking fountains are placed at convenient points along the track, and a band stand for open-air concerts is one of the features of the field within the track. The cost of constructing the bicycle track was about $20,000.

STATISTICS OF FINANCIAL OPERATION OF WATER-WORKS.

The table printed this month gives the statistics of the financial operation of the works in the cities included in the table printed in the January number of MUNICIPAL ENGINEERING, giving capacities of works in certain cities of more than 100,000 population.

It will be noted that most of the works owned by cities have a bonded indebtedness considerably less than the cost of the works, indicating that there are ample sinking fund provisions or their equivalent. The exceptions are Atlantic City, N. J., Kansas City, Mo., and Syracuse, N. Y., where the works have recently been purchased by the city, Newark, which has just bonded itself for a new plant not yet fully accepted, and Providence, R.I.

A comparison of the columns of cost of maintenance and receipts for water rents for 1895 shows in

STATISTICS OF FINANCIAL OPERATION OF WATER-WORKS. CITIES OF MORE THAN 100,000 POPULATION. 1896.

City.	Cost of Water-Works.	Capital Stock Paid Up.	Bonded Indebtedness.	Contract with City.	Cost of Maintenance 1895.	Average Annual Cost of Maintenance 10 years.	Receipts from Water Rents 1895.	Average Annual Receipts from Water Rents. 10 Years.	Water Supplied Free to City for what Purposes.	Annual Charge to City for Hydrant	Fountain.	Water Trough.	Street Sprinkling.	Sewer Flushing.
Albany, N. Y.	$3,020,000	.....	$1,609,500	Owned by city	$117,000	slightly less.	$294,000	$178,098‖	All.	.....	.....	.....	.....	.....
Atlantic City, N. J.	871,782	.....	875,000	City has very recently purchased the works.				....	All.	.....	.....	.....	.....	.....
Baltimore, Md.	15,000,000	.....	6,000,000	Owned by city	$609,573	....	$430,366	.....	.....	.....	.....	.....	.....	.....
Chicago, Ill.	22,894,214	....	4,638,000	Owned by city	1,758,242‡	....	3,158,492‡	.....	.....	.....	.....	.....	.....	.....
Cincinnati, Ohio.	9,087,695	....	1,175,000	Owned by city	527,447	$428,536‖	780,422	699,281	.....	.....	.....	.....	.....	.....
Denver, Colo.	3,707,000*	$1,500,000*	.....	Term 20 yrs.. Expires 1910.	.....	50,000*	.....	300,000*	Sewer, City Hall and Sprinkling.	$35	.....	.....	.....	.....
Detroit, Mich.	6,121,245	....	1,183,000	Owned by city	107,000	90,000	428,772	390,000	All but parks	which	pay $1.	000 a ye	ar.	
Jersey City, N. J.	5,800,000	....	....	Owned by city	109,368	....	.....	466,000*	All.	.....	.....	$20	.....	.....
Kansas City, Mo.	3,000,000	....	3,000,000	City has very recently purchased the works.				....						
Milwaukee, Wis.	4,633,435	....	1,600,000	Owned by city	$18 632	....	$441,932	.....	Fountains and Flushing.	$20	.....	$10	.....	.....
Minneapolis, Minn.	3,000,000	....	1,230,000	Owned by city	65,000	....	211,000	.....	All.	.....	.....	.....	.....	.....
Newark, N. J.	a3,337,500	....	b 7,492,000	Owned by city	28,421	c $28,000	549,041	Increase $15,000 to $20,000 each yr.	All.	.....	.....	.....	.....	.....
Omaha, Neb.	3,500,000 (about)	4,250,000 (authorized)	4,500,000 (about)	Fixes rates. City can purchase after 1900.	159,344	161,546*	373,766	$381,565*	Park, schools, water troughs, flush sewers and gutters.	250@$84 31@ 10 rem. @ $60.	.....	.....	.....	.....
Philadelphia, Pa.	28,856,109	....	....	Owned by city	1,113,470	532,343	2,616,089	2,221,469	All.	.....	.....	.....	.....	.....
Providence, R. I.	6,119,085	....	6,800,000	Owned by city	72,091	59,917	465,223	393,294	Drinking Fountains.	$30	.....	$40 to $450	2c. per 100 gal.	.....
Rochester, N. Y.	6,900,000	....	5,000,000	Owned by city	100,000	100,000	375,000	.....	Public buildings and schools.	$100,000	paid for all.		.....	.....
Syracuse, N. Y.	3,800,000	....	3,800,000	Owned by city	.....	.....	200,000	.....	.....	$40,000	paid for all.		.....	.....

° In 1890. ‡ In 1894. ‖ 1880 to 1890. ¶ For 7 years. * For 2 years.
a Old system. b Includes $4,000,000 for new supply. c For 3 years.

most instances an excess of receipts sufficient to pay an average interest of six per cent. on the bonded indebtedness and have a good balance for the sinking fund. The exceptions are Baltimore, where there would be a deficiency on this assumption amounting to more than the receipts from water rents, Providence, where there is a slight deficiency, and Rochester. These figures indicate that municipal ownership of water-works, for the larger cities at least, is not a losing venture. When the amount of free water furnished for fire protection and public uses is taken into account, the financial success of the works is still more evident. When the use of water is universal in a city this state of affairs is not seriously objectionable, though even then the large users of water must frequently pay more than their just proportion of the cost of fire protection to the city. A very few cities assess part or all the cost of new pipe on the abutting property, which tends to equalize the burden. But two of the cities in the list charge themselves with hydrant rental, viz.: Milwaukee $20 each, and Providence $30 each, but Rochester pays $100,000 and Syracuse pays $40,000 a year to its water department for fire protection and

A SECTION OF THE BICYCLE TRACK IN GARFIELD PARK, CHICAGO.

public uses. Denver pays $35 and Omaha $60 to $84 to private companies for each hydrant. City works are certainly not exorbitant in their charges for fire protection.

STANDARD TESTS FOR PAVING BRICK.

By Almon D. Thompson, City Engineer, Peoria, Ill.

The National Brick Manufacturers' Association has recently adopted specifications governing standard methods for conducting tests on paving brick, which give in detail the methods to be employed in the various tests, together with the conclusions reached by the association regarding their value. These specifications embody the results obtained by a special committee after two years of experimenting, who state, in substance, that all tests of paving brick are valueless, as indicative of their wearing qualities, except that of abrasion.

The report of the committee as given in the March number of MUNICIPAL ENGINEERING indicates that the abrasion test was more thoroughly investigated than the others, but exception must be taken to many of their conclusions regarding the manner of conducting this test. Their recommendations regarding the length, diameter and speed of rattler, and the per cent. of charge in same which give the greatest abrasion, agree with the results of experiments conducted by previous investigators.

The committee states that iron and stone used as an abrading material give unsatisfactory and irregular results. The fact regarding the use of stone was established to the satisfaction of the writer more than two years ago, but the committee evidently did not conduct a sufficiently extensive series of experiments to warrant their conclusion that cast-iron scraps of the proper size give unsatisfactory results as an abrading material. According to their published report, this conclusion was reached after experimenting with but two sizes of scrap iron. In the first series, charges of foundry shot varying in amount from 5 to 25 per cent. of the volume of the rattler were used, "no piece of which weighed above 1½ lbs., and most of which did not exceed 8 ozs." In the second series the other extreme was reached, and similar charges of cast-iron bricks weighing about 7¼ lbs. each, with rounded corners and edges, were used for the filling material. The results proved what might have been surmised, namely, that the losses with the use of small pieces of scrap iron were "insufficient to show the relative qualities of the bricks," and that with the large heavy pieces, the losses were very severe and irregular, the bricks and machine both being broken. A fair interpretation of these results would indicate that the pieces of iron used in the first experiment were too small, and those used in the second were too large, to procure proper results, but they can not be taken to prove that cast-iron as a filling material is impracticable, nor do they furnish sufficient grounds for the rejection of cast-iron as an abrading material, as recommended by the committee.

After a careful comparison of results obtained by using brick alone

for a charge in the rattler test, with the use of brick and cast-iron, the writer adopted cast-iron for the abrading material, as giving more uniform results, with less breakage of the samples. Numerous experiments with various sizes of cast-iron scraps also led to the adoption of scrap iron revolved until the abrasion test under these conditions for the past two years, and has found the results very uniform and an accurate indication of the quality of the samples. The small particles of iron give a grinding effect which produces an appreciable wear on the tough bricks and extreme wear on the soft ones, while the blows

SUBWAY ENTRANCE TO BICYCLE TRACK IN GARFIELD PARK, CHICAGO.

sharp corners are worn off, ranging uniformly in weight from one-fourth of a pound to five pounds, and divided into six equal portions of the following weights.

¼ lb. to ½ lb.
½ lb. to 1 lb.
1 lb. to 2 lbs.
2 lbs. to 3 lbs.
3 lbs. to 4 lbs.
4 lbs. to 5 lbs.

The writer has conducted the

of the heavier pieces discover the brittle samples. If bricks alone are used, the entire charge must be composed of the samples to be tested, or the results will not be uniform, the bricks having sharp corners at first, which are rapidly worn, with the sample continually approaching a rounded form and the abrading effect constantly growing less. Bricks from different lo-

calities vary so much in hardness that their use as a filling material would prevent a comparison of the results obtained in different localities. Again, there is no fixed proportion to be used of hard bricks which maintain their hard corners, or soft ones which are easily worn rounded. The advantages of scrap iron for the filling material are, (1) fewer samples are required to make the test; (2) the results are more uniform; (3) there is less breakage of the samples; (4) cast-iron being practically of uniform hardness, it forms a safe basis of comparison at different points; (5) the abrasion and pounding with cast-iron scraps approximates the wear met in a pavement, giving a basis for computation on the probable life of a pavement.

The reasons given for adopting the resolution recommending the abandonment of the absorption test appear to be that a small amount of moisture was taken up by all bricks after exposure, which was not entirely driven off after the sample had been exposed to a heat of 220 to 240 degrees F. for a period of 168 hours; also that samples, after immersion for twenty-four weeks, were still absorbing water. There is no more certain indication of the thoroughness of vitrification than the amount of water which a brick will absorb, and it is surprising that the association would recommend the abandonment of this test upon the above grounds. All paving bricks take up a slight amount of moisture, which might be termed "residual moisture," and which it is not necessary to drive off. Every test of paving brick is purely comparative, the constantly changing standard being the results obtained under standard operating conditions by the most durable bricks manufactured. The amount of residual moisture is practically constant in all good paving bricks, because of their almost non-absorptive qualities and the impervious enclosing shell which prevents the moisture from reaching the interior, even when immersed in water. The latter fact is recognized by the association, in the recommendation that the absorption test, if made, should be conducted upon bricks which have been through the rattler, or which are broken, to expose the inner surface. It is therefore not necessary to drive off the slight amount of moisture remaining after the excess absorbed by exposure to the elements has been driven out. This excess can be disposed of by heating the sample a few hours in a gas oven, which reduces all first-class pavers to a common basis before immersion. Since the relative amount of absorption is all that is required, immersion for forty-eight hours is a sufficient period to produce an appreciable effect upon the most thoroughly vitrified bricks.

The report recommends that in the absorption test the bricks be dried for forty-eight hours, and then immersed in water for the same length of time. The position of the committee appears to be untenable upon this point, when they state among the facts proved by their tests the following: "That to obtain accurate figures as to the absorption of any hard brick will require not less than four days' drying and eight weeks' soaking." If this fact was proved, there should be no grounds for conducting the test in the manner they recommend. The strongest point which they considered for the abandonment of the absorption test was that a brick which endures a satisfactory rattler test will not absorb sufficient water to be damaged by frost. The interpretation of the absorption test

as indicating the probable damage by frost has long been abandoned by engineers familiar with this subject, but it is of great value as an indication of the degree of vitrification of a brick, upon which depends its toughness and wearing qualities. A brick which absorbs too much water is considered not sufficiently vitrified, while an absorption of no water in forty-eight hours indicates a brick which may be too brittle, which fact is left to the abrasion test to prove.

The cross breaking and crushing tests are recommended as optional, because "it is not possible to show any close relationship between the qualities necessary for a good paving material and high structural strength, as indicated by either of these tests." The high structural strength is not merely related to the qualities necessary for a good paving material, but it is one of the qualities demanded. This can be determined by the cross breaking test, omitting that of crushing, because of the close relationship between the transverse and crushing strength. The possibility of the brick resting upon an uneven bed in the pavement, or of a heavy load applied near the end of the brick when the bearing is even, demands a high transverse strength. A durable brick must be free from cooling cracks and laminations, and possess a homogeneous dense structure. Neither the abrasion nor absorption

INDEPENDENCE AVENUE, KANSAS CITY, MO.

test discovers these conditions. The writer has conducted tests upon paving bricks in which the laminations formed well defined concentric rings, with a middle core. These samples would in many instances pass a high abrasion test, but would develop a low transverse strength. The same is true of bricks with cooling cracks. Examinations of pavements laid with similar bricks show that the layers were worn off separately by the traffic and disintegrated by freezing. A high transverse strength also indicates toughness, a brittle or soft brick giving, in every instance, low results.

A good paving brick may be tough, without being brittle, homogeneous in structure, free from laminations, non-absorptive, and must possess a high transverse strength. There is no single test yet devised which will determine these qualities. The abrasion test at present more nearly fills this condition than any other single test, but even should it be so conducted as to determine all the above qualities, it would not be wise to depend upon a single test. A few years since the city of Cincinnati required paving bricks to fill a severe absorption test. In a short time pavers were produced which met this condition easily, but which proved worthless in the pavement.

The three tests of abrasion, absorption and cross breaking are absolutely necessary to determine the qualities of a good paver. The abrasion test is the best single indication of toughness. The amount of absorption indicates the degree of vitrification. Cross breaking determines the structural strength and homogeneousness of the material. Each test, therefore, performs a special duty, and also is a check upon the brittleness and softness of the sample, which are the two greatest enemies of durability.

SUPPLEMENTAL SPECIFICATIONS BY THE PAVING BRICK COMMISSION.

We have received a number of letters calling attention to deficiencies in the report of the Commission on Standard Specifications for Testing Paving Brick as published in the pro eedings of the National Brick Manufacturers' Association. In a letter of explanation, Prof. Edward Orton, Jr., says that "the recommendations of the N. B. M. A. commission, as passed, were left out from published reports, and also the latter are incomplete. In fact, what was published, was only a hasty digest of the real report, which will be published soon with drawings, charts, etc. I would like to have you explain this fact, and ask your readers to suspend judgment till the final report is published. I think the work of our commission can be made very useful to the municipal engineers of the country if it is brought before them in the proper light, but if they are allowed to regard the first account of the matter as final, they will be disgusted, and with cause. Kindly correct the impression which will otherwise be created against our work."

Supplemental to the report of the commission heretofore published, Prof. Orton sends us the following specifications for tests and the accompanying table:

SPECIFICATIONS FOR A STANDARD METHOD OF CONDUCTING THE RATTLER TEST FOR PAVING BRICK.

I. Dimensions of the Machine.—The standard machine shall be 28 inches in diameter and 20 inches in length, measured inside the rattling chamber.

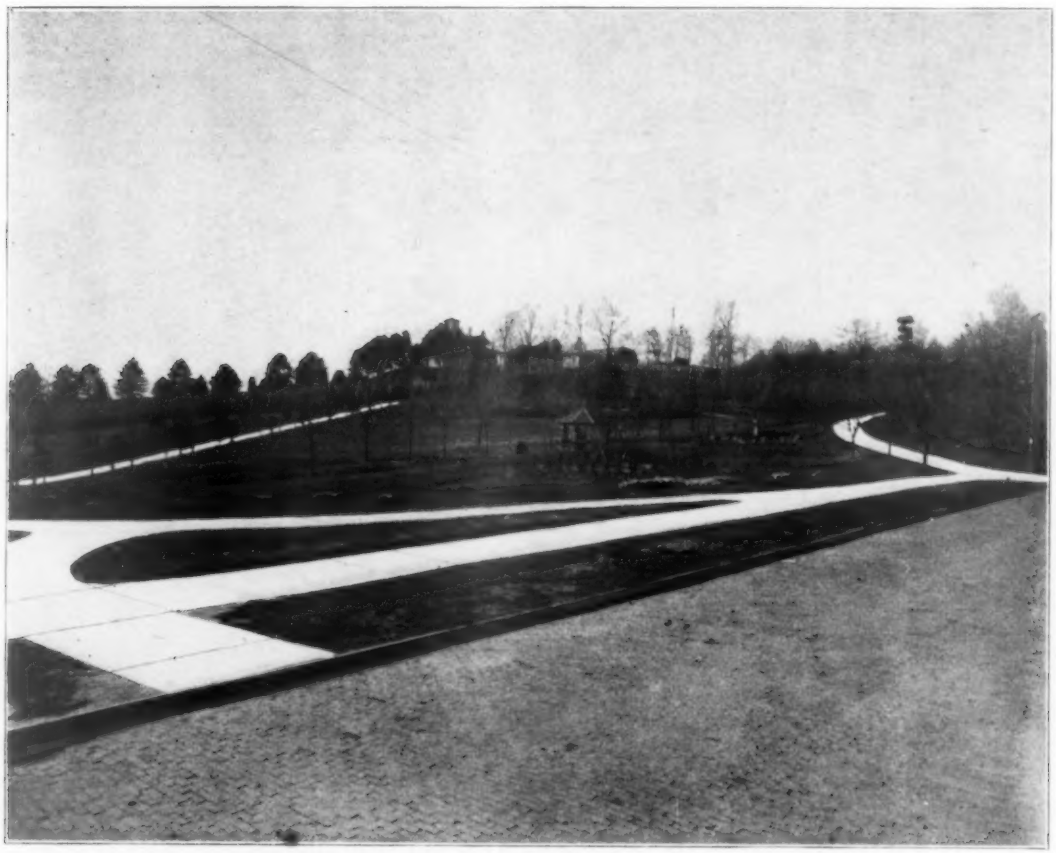
Other machines may be used varying in diameter between 26 and 30 inches, and in length from 18 to 24 inches; but if this is done, a record of it must be attached to official report. Long rattlers may be cut up into sections of suitable length by the insertion of an iron diaphragm at the proper point.

II. Construction of the Machine.—The barrel shall be supported on trunnions at either end; in no case shall a shaft pass through the rattling chamber. The cross section of the barrel shall be a regular polygon having 14 sides. The heads and staves shall be composed of gray cast-iron, not chilled or case hardened. There shall be a space of one-fourth of an inch between the staves for the escape of dust and small pieces of waste. Other machines may be used having from 12 to 16 staves, with openings from one-eighth to three-eighths of an inch between staves; but if this is done, a record of it must be attached to the official report of the test.

III. Composition of the Charge.—All tests must be executed on charges composed of one kind of material at a time. No test shall be considered official where two or more different bricks or materials have been used to compose a charge.

IV. Quantity of the Charge.—The quantity of the charge shall be estimated by its bulk and not its weight. The bulk of the standard charge shall be equal to 15 per cent. of the cubic contents of the rattling chamber, and the number of whole brick whose united volume comes nearest to this amount shall constitute a charge.

V. Revolutions of the Charge.—The number of revolutions for a standard test shall be 1800, and the speed of rotation shall be 30 per minute. The belt power shall be sufficient to rotate the rattler at the same speed, whether charged or empty. Other speeds of rotation between 24 and 36 revo-



A VIEW OF KRUG PARK, ST. JOSEPH, MO.

TABULATED RESULTS OF A SERIES OF TESTS ON THE EFFECT OF STRUCTURE IN THE WEARING POWER OF PAVING BRICK.

Series Number.	Test Number.	Composition of Charge.			Rattler Tests.						Cross-Breaking.		
		Standard Brick.	Other Brick.	Test Brick.	Percentage of Loss on 1000 Revolutions.	Percentage of Loss on 2000 Revolutions.	Average Loss of Test Brick in 1000 Revolutions.	Average Loss of Test Brick in 2000 Revolutions.	Description of Brick.	General Average of All Brick of One Type.	Number of Brick Tested.	Average Modulus of Rupture.	General Average of All Brick of One Type.
I	1	8	0	5	14.13	21.41							
I	2	8	0	5	16.43	21.62	15.59	21.43			5	2374	
I	3	0	5 X	8	16.21	21.27							
II	4	9	0	4	21.96	31.94	21.96	31.94					
III	5	8	0	5	17.30								
III	6	8	0	5	16.88	22.68	17.94	24.47			4	2710	
III	7	0	4 IX 1 XII	8	19.63	26.27							
IV	8	8	0	5	17.40								
IV	9	9	0	4	18.93	26.83	19.45	28.13					
IV	10	8	0	5	20.36								
IV	11	8	0	5	21.11	29.44							
V	12	8	0	5	14.68	24.47							
V	13	8	0	5	21.98	30.58	17.29	26.14			5	2008	
V	14	5	0	8	15.22	23.39							
VI	15	8	0	5	20.43	26.88	20.43	26.88			2	2370	
VII	16	8	0	5	27.30								
VII	17	8	0	5	31.22	42.39	25.90	34.02			4	2920	
VII	18	0	6 XIV	7	19.18	25.65							
VIII	19	8	0	5	20.00	28.32	23.33	32.72			3	2497	
VIII	20	11	0	2	26.67	37.13							
		Average of 106 End Cut Bricks—19.54 and 27.00.							End Cut, Plain.	47 Bricks, made on 4 different machines, in 9 different tests, 21.05% and 28.48%.	*Average of 23 End Cut Brick, 2463.*		14 Bricks, made on 4 different machines, in 4 different tests, average 2425.
													9 Bricks, made on 2 different machines, tested in 2 different tests, 2526.
IX	21	8	0	5	19.10								
IX	22	8	0	5	24.81	33.43	21.10	29.81			3	1933	
IX	23	0	III 8 XII 1	4	19.41	26.19							
X	24	8	0	5	24.60								
X	25	8	0	5	44.11	52.31	32.19	44.07			5	2128	
X	26	0	I 8	5	29.83	35.64							
X	27	0	IX 4 III 8	1	30.22	44.26							
XI	28	8	0	5	20.00	29.59	20.00	29.59			3	3127	
XII	29	8	0	5	25.50								
XII	30	10	0	3	16.97	21.27	21.23				3	1973	
XIII	31	8	0	5	27.90								
XIII	32	10	0	3	21.10	33.00	24.35				2	2775	
XIV	33	8	0	5	23.88	33.25	23.88	33.25			2	3030	
XV	34	8	0	5	22.00								
XV	35	8	0	5	22.49	35.83	21.73	31.37			5	2126	
XV	36	0	7 VII	6	20.72	27.90							
		Average of 72 Side Cut Bricks—24.43 and 32.90.							Side Cut, Plain. Side Cut, Repressed.	37 Bricks, made on 4 different machines, tested in 8 different tests, average 22.73% and 31.42%. 35 Bricks, made on 3 different machines, tested in 8 different tests, average 26.51% and 35.30%.	*Average of 23 Side Cut Brick, 2547.*		12 Bricks, made on 4 different machines, and tested in 4 tests, average 23.46. 11 Bricks, made on 3 machines, in 3 different tests, average 2347.
XVI	37	9	0	4	19.40	25.20							
XVII	38	10	0	3	23.80	28.26	21.09	27.72					
XVIII	39	9	0	4	20.07	29.71							
		Average of 11 Dry Pressed Bricks—21.09 and 27.72.							Dry Pressed, Coarse. Medium. Fine.	11 Bricks 21.09 and 27.72.	3 3 3	2507 2740 2687	2644
											Average of 9 Dry Press Brick, 2644.		

lutions per minute may be used; but if this is done, a record of it must be attached to the official report.

VI. Condition of the Charge.—The bricks composing a charge shall be dry and clean, and as nearly as may be possible in the condition in which they are drawn from the kiln.

VII. The Calculation of the Results.—The loss shall be calculated in per cents of the weight of the dry brick composing the charge, and no result shall be considered as official unless it is the average of two distinct and complete tests, made on separate charges of brick.

SPECIFICATIONS FOR A STANDARD METHOD OF CONDUCTING AN ABSORPTION TEST FOR PAVING BRICKS.

I. The number of bricks for a standard test shall be 5.

II. The test must be conducted on rattled bricks. If none such are available, the whole bricks must be broken in halves before treatment.

III. Dry the bricks for 48 hours at a temperature ranging from 230° to 250° F. before weighing for the initial dry weight.

IV. Soak for 48 hours completely immersed in pure water.

V. After soaking, and before weighing, the bricks must be wiped dry from surplus water.

VI. The differences in weight must be determined on scales sensitive to one gram.

VII. The increase weight due to water absorbed shall be calculated in per cents of the initial dry weight.

A VIEW OF UNIVERSITY PARK, INDIANAPOLIS.

The following resolution was then presented, and after most careful discussion of all the facts brought out by the data of Messrs. Harrington and Orton, was adopted unanimously:

Resolved, That in the opinion of the commission, any paving brick which will satisfy the requirements of reasonable mechanical tests will not absorb sufficient water to prove injurious to it in service. We therefore recommend that the absorption test be abandoned as unnecessary, if not actually misleading.

SPECIFICATIONS FOR THE STANDARD METHOD OF MAKING CROSS BREAKING TESTS OF PAVING BRICK.

I. Support the brick on edge, or as laid in the pavement, on hardened steel knife edges rounded longitudinally to a radius of 12 inches and transversely to a radius of one-eighth inch, and bolted in position so as to secure a span of six inches.

II. Apply the load to the middle of the top face through a hardened steel knife edge, straight longitudinally and rounded transversely to a radius of one-sixteenth inch.

III. Apply the load at a uniform rate of increase till fracture ensues.

IV. Compute the modulus of rupture by the formula

$$f = \frac{3\ W.\ l}{2\ b\ d^2}$$ in which

f = modulus of rupture in pounds per square inch.
w = total breaking load in pounds.
l = length of span in inches = 6.
b = breadth of brick in inches.
d = depth of brick in inches.

V. Samples for test must be free from all visible irregularities of surface or deformities of shape, and their upper and lower faces must be practically parallel.

VI. Not less than 10 brick shall be broken and the average of all be taken for a standard test.

SPECIFICATIONS FOR THE STANDARD METHOD OF MAKING CRUSHING TESTS OF PAVING BRICK.

I. The crushing test should be made on half-bricks, loaded edgewise, or as they are laid in the street. If the machine used is unable to crush a full half-brick, the area may be reduced by chipping off, keeping the form of the piece to be tested as nearly prismatic as possible. A machine of at least 100,000 pounds capacity should be used, and the specimen should not be reduced below 4 square inches of area in cross section at right angles to direction of load.

II. The upper and lower surfaces should preferably be ground to true and parallel planes. If this is not done, they should be bedded in plaster of paris, while in the testing machine, which should be allowed to harden ten minutes under the weight of the crushing planes only, before the load is applied.

III. The load should be applied at a uniform rate of increase to the point of rupture.

IV. Not less than an average obtained from five tests, on five different bricks, shall constitute a standard test.

The following resolution was then presented and unanimously adopted:

WHEREAS, From the experimental work done so far by this commission, or by others so far as is known to us, in the application of the cross breaking and crushing tests to paving bricks, it is not possible to show any close relationship between the qualities necessary for a good paving material and high structural strength as indicated by either of these tests.

Resolved, That for this reason the commission recommends that these tests shall be considered as purely optional in the examination of paving material, and not necessary as a proof of excellence.

THE MODEL SYSTEM OF BOOKKEEPING FOR WATER COMPANIES. II.

THE METERED WATER REGISTER.

In the March number of MUNICIPAL ENGINEERING the forms used by water-works companies were for the sake of convenience in treating them separated into five classes, the first including the preliminary applications, permits, inspection reports and other blanks through which applicants for water privileges first become officially connected with the company as water consumers. A comprehensive form was suggested which, when properly handled, becomes an important part of the permanent records of the company from that time on, and greatly simplifies the labor not only of that branch of the work, but makes a self-indexing record of much convenience in connection with the second class of forms. The second class embraces all those office books containing the showings of resources and liabilities and receipts and expenditures.

The books which make up this second class are essentially those required in the systematic handling of any mercantile business, viz., cash-book, journal and ledger, but as Solomon once said, "Of making many books there is no end," and so modern bookkeeping methods have divided these fundamental records into many minor ones, which are confined to particular uses, and this specialization is now followed to its extreme limit by water companies, to their great advantage. The cash-book is divided into a record of receipts and expenditures, and these again occasionally into others for the entry of receipts from various sources and for expenditures upon construction, or maintenance, or general account, or such other classifications as the circumstances seem to demand. Some companies employ from fifteen to twenty different books in this class, though many of them are little more than mere blotters or books of memoranda. Others find their needs amply satisfied with the three primary ones only.

In an ordinary mercantile establishment where accounts with individuals are constantly fluctuating, and where the number of such accounts is apt to be small and the size of the items proportionately large, it is customary to throw all individual accounts into the general ledger. But a water company having, it may be, thousands of patrons, most of them at a fixed rate, the average charge to each being somewhere between ten and twenty dollars, finds it better to employ one or more consumers' ledgers, which are books of original entry and partake of the nature of both journal or sales book and ledger. The sum total of the charges to any one class of consumers, as, for instance, metered water patrons, is taken as a whole and by a journal entry carried as a debit in the general ledger to an account which represents that entire body of patrons in a lump, which is called the "metered consumer" account, or some similar designation. In the same way, payments upon these accounts are credited to the individuals in the consumers' ledger, but find their way into the general ledger as a credit to the proper accounts only in the form of totals, which are posted, in some cases, daily, in others weekly, and in others once a month.

As a matter of fact, most companies should use three kinds of individual or consumers' ledgers: (1) the metered water register, (2) the rated or flat rate register, and (3) the special register for all classes of service not included in the other two. Small companies may for convenience have these all bound in one book, but the treatment of the different classes of service differs so essentially that most companies prefer to have them at least upon different pages, ruled appropriately to their particular requirements.

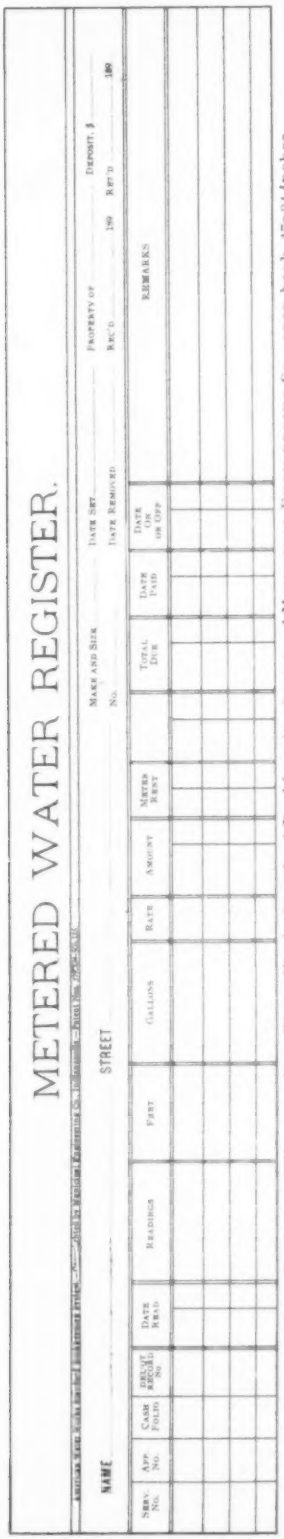
THE METERED WATER REGISTER.

For illustration we will assume that John Jones, residing at No. 13 Chestnut street, Crystal Lake, desires to obtain water privileges of the Crystal Water Co., and, the ordinance being favorable, he makes application for water at meter rates. He describes in his signed application the nature of the service desired, and a permit is issued to him to employ an authorized plumber to connect his water pipe with the company's main. Many companies require an advance cash payment of five or ten dollars before permit is issued, a receipt for which is given and applied upon his first bill, or

in case the company makes the connection itself the deposit is applied to the payment of the cost of the work, and the balance, if any, returned to the patron, or applied as above. The connection being made, the plumber returns the permit, with full description and diagram of the connections which he has made, as provided for upon the back of permit. It has been suggested that a receipt should be given to the plumber for this report when it is turned in, thus avoiding all occasion of future dispute growing out of carelessness in handling the report. If the plumber produces a receipt he can not be held responsible for the failure of the company to properly record the report; if he can not he should be held liable for any loss growing out of his neglect.

The report being received, the company's inspector passes upon the work, and being found within the requirements, turns the water on and makes his return to the office. The Jones application has already been filed under Chestnut street, No. 13. The permit, with description of service, is now recorded in the metered water register, and afterwards filed in a separate receptacle under "Jones," both permit and application having been given their register or consumer's number. The metered water register which contains this record should allow ample space for monthly entries, it being the general rule to render meter bills monthly, although some companies render them quarterly. It should provide for entry of Jones' name, street and number, and the make, size and number of the meter. It should show to whom the meter belongs, and if to the company, the amount of the deposit, if one is required, the date of receipt of deposit, the date the meter is set, when removed, and the date the deposit is returned. At least one page should be given to each consumer where monthly readings are taken, and each of the above entries being made but once should be separated from the remaining ones, preferably being at the head of the page. In the body of the page columns should be provided for the dates of meter readings and the readings, the next column showing the difference between readings or the amount consumed. A number of companies submitting blanks on the MUNICIPAL ENGINEERING prize competition waste labor and material by entering in this column the current reading, bringing down from above the previous one, and placing the difference beneath.

Others adopt the very obvious but somewhat unnecessary course out of the difficulty by beginning the year's business on the lower line and placing the entries one above the other, in order that the orthodox method of subtraction need not be deviated from; but, as one correspondent writes, if a man can not subtract downwards without standing on his head, if he will take a half hour off some time and practice, he will find it easy enough. Consequently, the simple plan is the one usually followed. The readings are placed one beneath another, and the differences upon the same line in the next column; then, as readings are generally in cubic feet and bills rendered in gallons, the next column should be set aside for the amounts consumed in gallons. Labor may be saved in making these extensions by having ready at hand a prepared table giving the equivalent in gallons of the ordinary and most common amounts in cubic feet found to be consumed. Next should be a column for the



METERED WATER REGISTER.

NAME — STREET — MAKE AND SIZE — No. — DATE SET — DATE REMOVED — PROPERTY OF — RECD — DEPOSIT, $ — RETD — 189

SERV. No.	APP. No.	CASH PAID	DEPT. RECD. No.	DATE READ	READINGS	FEET	GALLONS	RATE	AMOUNT	METER RENT		TOTAL DUE	DATE PAID	DATE ON OR OFF	REMARKS

Metered Water Register, of The American Water-Works Standard Bookkeeping System of MUNICIPAL ENGINEERING Co., open book, 17¾ inches.

rate charged, and where, as is generally the case, one rate is charged up to a certain amount, and a lower one for all in excess of that, the two rates can be readily placed one above another on the same line, and the extensions carried into the "amount" column next to the right. As it is the practice of some companies to charge a certain fixed rental for the use of the meter, a column should be provided for the entry of this amount, and a blank one will not be amiss for the recording of unusual or special charges or deductions. A total column should follow, into which the entire amount due is carried, another for the date of payment, another for the record of the times of turning water on and off, and sufficient space at the margin for explanatory remarks. Add to these in a convenient location a column for the entry of the cash book folio, upon which the payment is originally recorded, and from whence it is posted to this register; and another column to show the page of the delinquent record, into which the charge is carried if not settled by a stated time, and the metered water register is practically complete and answers every reasonable demand that can be made upon it.

The accompanying illustration shows, in a reduced form, a register of this class designed by MUNICIPAL ENGINEERING after a careful study of the requirements of many companies as evidenced by blanks which they are now using.

While a full description of some of the forms submitted in the prize competition would doubtless prove interesting, a brief allusion only to one of the best of them can be given at this time. That is the consumer's register of the Denison City Water-Works Company, of Denison, Texas. This company is operated by a syndicate, and all

of its blanks show evidences of extreme care in their preparation. Their chief features will, with those of others, be alluded to from time to time hereafter. The consumer's register of that company is a large book, each page measuring 16-in.-x21-in. high. One page is assigned to a patron and contains lines for twelve monthly entries in each year for six years—1896 to 1901 inclusive. At the head of the page are lines for name, address, location of stop-box, size of tap and total rate. Columns are provided with the following headings in the order given: "Deposit," "Amount," "Water Rents," "From," "To" (sub-heads), a general heading "Meter Data," with sub-heads "Date of Reading" (months being printed beneath throughout the length of the column), "Meter Reading," "Cubic Feet Consumed," "Gallons Consumed," "Rate per Thousand," full headings "Amount Due," "When Paid," "Amount Paid," "Cash Book Folio," and "Uses," the latter column being a wide one and designed to accommodate a full description of the service, a record of necessary facts regarding meter and remarks. The book is necessarily a large one.

In the May number other blanks in this class will be taken up.

Books described as a part of the system adopted in the "American Water-Works Book-keeping System," are made by MUNICIPAL ENGINEERING COMPANY under copyrights and patents.

METHODS OF CEMENT TESTING.

Several weeks ago MUNICIPAL ENGINEERING submitted a series of questions concerning methods of cement testing to a number of civil engineers, chemists and others known as authorities on the subject. This is in line with the investigation and discussion of questions relating to cement which has been in progress in MUNICIPAL ENGINEERING for over a year, and which will be continued. Many answers have been received, and the first installment of these we give below. This information is of timely importance in connection with the investigation now in progress by a committee representing the American Society of Civil Engineers. The answers will be made the basis of discussions in later numbers of MUNICIPAL ENGINEERING. The questions submitted were as follows:

Test for Fineness—Sieves.

(1) What size of mesh should be used in testing fineness?

Weight Per Cubic Foot.

(2) Is the test of weight per cubic foot of sufficient value to be retained, and if so, what method should be employed?

Specific Gravity.

(3) Do you consider the test for specific gravity of value (a) for Portland? (b) for natural cement?

(4) What form of apparatus do you prefer for this test?

Chemical Analysis.

(5) Under what conditions do you consider a chemical analysis essential?

Time of Setting.

(6) What do you consider the best method of determining the consistency of mortars for this test?

(7) Should the time of setting be determined for mortars containing sand as well as for neat cement mortars?

(8) What method do you prefer for this test, and what special conditions are desirable in its execution?

Soundness.

(9) What in your opinion constitutes a practical and sufficient test for soundness, (a) of Portland? (b) of natural?

Tests of Strength.

(10) What do you consider the most valuable strength test that is practicable to execute under ordinary conditions?

(11) Do you consider that the form of mold recommended by the American Society of Civil Engineers' committee in 1885 for tensile tests, and now in general use in this country, can be improved, and if so, in what direction should modification be made?

(12) How may the consistency of the mortar be defined and determined so that different laboratories may employ mortars of the same consistency?

(13) What do you consider the best method of mixing mortar for tensile or other tests?

(14) What method of filling the molds and finishing the specimens will give most nearly uniform results?

(15) What special precautions should be taken with the briquettes from the time of molding until they are ready to break?

(16) What form of clip do you prefer for breaking briquettes in tension?

A few of the gentlemen to whom the foregoing questions were submitted replied with general statements. Mr. Wm. Barclay Parsons, C. E., of New York, while unwilling to answer the questions in advance of his consideration of the matter, as a director of the American Society of Civil Engineers, expressed the hope that our course would "not only meet with general approval, but will be productive of some good, as there is much room for improvement in the manner of testing cement."

Mr. Alfred P. Boller, writing from East Orange, N. J., says: "The cement question is a very big one from a laboratory point of view, and somewhat shrinks in dimensions from the practical working standpoint. Rapidity of results and simplicity of methods are what are needed in the field. Extreme scientific refinements are only practicable on those public works where time is no object, as on most all government and on much municipal work. I know of no subject where the line between theoretically exact and practically correct needs to be so sharply drawn. The proper place for refined testing is at the cement factories. Now that the American Society of Civil Engineers has appointed, or will shortly appoint, a committee to revise the old standard, so-called, let us wait until they get through their work, which will probably evolve some order out of the chaos. Most any cement that sets up good and hard and does not crack, as determined from pats, answers the requirement for most all engineering or architectural work, and if of a standard brand from a manufacturer careful of his reputation, an engineer is very safe in its use."

Mr. F. Collingwood, of New York City, writes: "As the methods to be pursued have now been under discussion for many years, I think it useless to indulge in generalities. For this reason the only opinions of value will be those of engineers and others who are actively engaged in cement testing and can give results from *recent* experience in testing, and not simply recapitulating those made under less favorable circumstances. What you want are exact details as to size of *mesh* and of *wire*, in tests for fineness; exact methods of manipulation in mixing, including *time* or some other measure of the work done; condition of samples as to contained moisture, age, exposure, if any; specific gravity, until it is determined by special tests to that end what effect this element has; special tests as to variations in consistency of mortar made with the same cement and with the special object of determining which gives the most uniform results. I am personally opposed to the dry mixtures. They undoubtedly give the greatest strength, but the chances of uniformity are small, and the conditions such as are rarely possi-

ble in practical work. I might thus go on through the whole list, but you will doubtless have replies from many who are now busy at such work and who can give later information than I can."

Mr. Louis L. Tribus, C. E., of New York, says: "While I should be glad to give additional information on the interesting questions involved, I rarely have necessity for using more than the ordinary and more or less crude methods of tests, so have no fixed convictions on the matter."

Mr. A. M. Mosscrop, C. E., of Rochester, N. Y., writes: "My intimate acquaintance with cement was about nine years ago; since then my position here as engineer (Rochester Bridge and Iron Works) has prevented my continuing that line of work any more than enough to keep up with the progress. I therefore feel that any answers that I might give to the series would not be entitled to much weight."

ANSWERS OF BERNARD L. GREEN.

Specific answers to the questions are given below in the numbered order. The first is from Mr. Bernard L. Green, C. E., of the Osborn Co., Cleveland, O., who says that his answers describe generally the methods in use in the Osborn Co. laboratory, though in a few cases the methods preferred have been given first place. "The reason for this," Mr. Green explains, "is that, as we state in our general remarks, we always prefer methods that will give results uniformly with those obtained in Germany, where, probably, the most careful and detailed attention has been given to the subject of cement testing." Accompanying the answers of Mr. Green is a copy of the report blank used by his company, and this is reproduced as a matter of interest connected with methods of testing and reporting results. Mr. Green's answers are as follows:

1. If there is to be but one sieve used, adopt preferably No. 100, or 10,000 measures per square inch, size of wire approximately one-third the distance center to center of wires. Further useful information may be obtained by using in addition the No. 74 or No. 80 sieves.

2. No. The information sought by this test is more accurately obtained by studying the results of tests for fineness and specific gravity.

3. (*a*) For a general test of an unknown brand of cement, no. When the general or standard qualities and characteristics of a given brand are known, the test is useful to determine the uniformity of the mixed ingredients and the thoroughness of burning. (*b*) Such a test is of less use than for Portland cements.

4. There are several good forms of apparatus. The Seger volumenometer may be mentioned as one.

5. Complete chemical analyses should be made of all cements from time to time, as a check on the quality of ingredients used. Beyond this they are often useful in locating definitely the cause of some fault indicated by the mechanical test. They are thus of more value to the manufacturer than to the consumer. Partial analyses for the determination of the lime, silica and sulphuric acid, made from time to time during the progress of a large piece of work, are useful as a check on the mechanical tests to determine the uniformity of the cement used.

6. The most practical, and at the same time a very accurate method, is to determine the proper amount of water by experiment. It should

[Copy of Blank for Reports of Cement Tests.]

CEMENT TESTING DEPARTMENT.

Report of Tests of..... .....Cement.
Samples.....189... From.....
Reported to.....189...

FINENESS, ACTIVITY, CONSTANCY OF VOLUME.

Brand or Mark.	Fineness.		Time of Set.		Results of Pat Tests.		
	Per cent. passing No..... sieve.	Per cent. passing No. ..... sieve.	Initial. Hrs Min	Final. Hrs Min	In Hot Water.	In Cold Water.	In Air.

TENSILE STRENGTH IN POUNDS PER SQUARE INCH. (Results of tests of sets of five briquettes.)

Brand or Mark.	Proportions by Weight.		Per cent. of Water.	Age.....			Age			Age.....		
	Cement.	Sand.		Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.

COMPRESSIVE STRENGTH IN POUNDS PER SQUARE INCH.
(Results given for tests of sets of five..... .... inch cubes.)

Brand or Mark.	Proportions by Weight.		Per cent. of Water.	Age.....			Age.....			Age.....		
	Cement.	Sand.		Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.

CHEMICAL ANALYSIS.

Brand or Mark.	Lime. CaO	Silica SiO_2	Alumina Al_2O_3	Oxide of Iron Fe_2O_3	Magnesia MgO	Sulphuric Acid SO_3	Carbonic Acid CO_2	Alkalies	Moisture.

We certify that the above described tests were carefully made.

The Osborn Co.

By.....

be such that when the mortar has been thoroughly troweled for at least one minute for quick setting, or two minutes for slow setting cements, and then placed on a glass plate in a solid ball, a series of smart taps of the plate on the table will cause the ball to settle, without cracking, into a flat cake. Moisture should cause the surface to take on a shiny appearance not earlier than, say, the fifteenth tap of the plate, and, after the pat is formed, it should still have a stiff feeling when the trowel is used to smooth the surface.

7. Not at all necessary. Time of set is so greatly affected by external conditions that it is of value simply as a comparison of the activity of various cements.

8. Vicat's needle, though Gilmore's needles are perfectly reliable and satisfactory in experienced hands. Uniformity of temperature, both of water for mixing and of air

in laboratory; uniformity of consistency of mortar and of moisture in room; freedom from all drafts and shocks or jars during the entire time of the test.

9. Two pats of the consistency described under "6," placed on glass and kept in moist air for twenty-four hours, or at least until set, one then placed in water and the other allowed to dry out in air, test to continue at least twenty-eight days. We also use a hot test as follows: A pat like those described is placed immediately after molding in a closed copper box containing water at 120° F. for six hours. The pat is left on the shelf just above the water in moist hot air. Then it is placed in water for eighteen hours, the temperature kept constant at 120° F. during the whole twenty-four hours. This test is not entirely trustworthy and satisfactory taken alone, but it appears to be the best quick test for soundness we have thus far tried.

10. For a single test, that of the tensile strength of sand and cement mortar (for Portland cements, three sand to one cement; and for natural cements, equal parts) at the age of twenty-eight days. For complete tests of cements in use for work, first a series of tensile tests neat and with sand at seven days, twenty-eight days and three months, when possible, together with tests for fineness, activity, soundness, etc. Subsequently during the progress of the work periodical tensile tests of seven days, neat and with sand, together with fineness, activity and hot test.

11. No.

12. Only by the most detailed descriptions of methods of operation and conditions which should obtain during the progress.

13. By hand with a small trowel on a plate glass surface.

14. Probably the Bohme hammer can not be beaten. Accurate results may be obtained by hand by watching with great care all conditions of mortar during the progress of the work.

15. Keep them in moist air, free from drafts or jars for twenty-four hours. Keep the temperature of air of mixing and immersion and of the air in the laboratory at a constant temperature. Keep the immersion water clean and fresh at all times.

16. There are several good forms. Any good form will give a good proportion of fair breaks in careful and experienced hands. No form will do good work when carelessly used. In general, we hope to see much good come from the present agitation in the methods of testing cements. It is a difficult subject to formulate hard and fast rules upon, but such rules must be formulated and universally adopted to obtain uniform results. We favor the adoption of good machinery for as many of the various processes as possible, and a reduction of the irregularities due to hand work to a minimum. There is still room for study in the form of such machinery.

We are strongly in favor of the adoption of the methods, standards of weights, measures, machinery, etc., in use in Germany for the sake of obtaining an international uniformity of results. The Germans have gone so much farther than we have in the investigation of this subject, that we can better afford to follow them than to wrestle with any new system or any perfection along original lines of the general methods now in use in this country.

ANSWERS OF LEE TREADWELL, C. E.

In a letter written from Pencoyd, Pa., Mr. Lee Treadwell, C. E., says: "We are greatly in need of a more uniform method of manipulating tests of cement, and it is to be hoped that those who can speak with authority on the subject will aid you in your undertaking. I am sure that what you propose will be of great benefit to the engineering profession, as well as to contractors and builders." Mr. Treadwell's answers are as follows:

1. 10,000 per square inch for Portland cement; 2,500 per square inch for natural cement.

2. I consider the test of weight per cubic foot to be of value in the hands of the expert only. I would omit it from ordinary tests, unless there is some *reason* to believe that the cement has been adulterated, and even then the test is of *secondary* importance only.

3. Only in the hands of the expert, and that in special cases.

4. No preference. Any that will give accurate results.

5. When there is a suspicion that the cement may have been adulterated, or that some substance has been added to it to make it set more firmly in the laboratory tests.

6. The method recommended by a committee of the Am. Soc. C. E. some years ago.

7. Yes.

8. The best method that I have tried is that of allowing the mortar to stand for some time (which should vary) before molding the briquettes, then compare the strength of these briquettes with those molded from fresh mortar, and note the decrease in strength. But this method is long and expensive, so in most cases it is sufficient to follow the same test as that for neat cement.

9. My experience has been so variable that I can not recommend any one method as applicable to all Portlands or to all natural cements. For universal application the test recommended by the Am. Soc. C. E. is the best I know of. I consider the heat or boiling test valuable only in the hands of men of considerable experience, or, I might go further and say, in the hands of the expert.

10. Those recommended by the Am. Soc. C. E., but they are susceptible of considerable improvement in the minor details.

11. It has occurred to me that the length of the briquette might be made about one-half inch longer, so as to remove the bearing points of the clips to a point further from the smallest section of the briquette. This, however, is a point that could be settled by experimentation only.

12. *A difficult question to answer.* Each manufacturer knows what percentage of water added to his cement will give the best results, so it has occurred to me that it would not be a bad idea to have a table made and published giving the percentage of water that each manufacturer recommends to be used in making mortar for briquettes. This table could be revised from time to time and all laboratories could use it.

13. By hand, with a trowel. I have tried machine mixing, but never succeeded in getting satisfactory results.

14. My experience would indicate *very careful* hand mixing, but a perfect machine for that purpose is what we all long for. I have tried machine molding, but with more or less unsatisfactory results.

15. It should remain in the mold until set, and from the time of molding until placed in water it should be kept in an atmosphere thoroughly saturated with moist-

ure to prevent evaporation. The greatest care should be taken in handling the briquettes at all times.

FROM JEROME SONDERICKER, C. E.

Mr. Jerome Sondericker, C. E., of the Massachusetts Institute of Technology, Boston, answers questions 10, 11, 14 and 16, as follows:

10. It seems to me that a compression test possesses the following advantages as compared with tension:

a. The form of test piece (cube) is simple and compact.

b. Uniform methods of testing could be more easily secured, differences as regards form of molds and clips being avoided.

c. Compression tests, when properly made, give more uniform results than tension tests.

d. Fracture by compression results from the overcoming of the cohesion of the particles as well as fracture by tension; moreover, I know of no reason for assuming that a compression test would not indicate the relative value of different cements and mortars as satisfactorily as a tension test.

e. Stone is commonly tested in compression and this is also a more convenient test for concrete. The adoption of a compression test for cement would, I think, tend to develop the practice of testing concrete, sand, mortar, etc. The importance of such tests is obvious.

f. The more powerful testing machines necessary is, doubtless, the strongest objection to adopting a compression test. Such a machine would, however, be available to some extent for testing stone, brick, concrete, etc., and on the other hand the usual machines for testing iron would be available, when furnished with suitable compression apparatus, for testing cement.

11. It is desirable that the briquette should be of such form as to give the full tensile strength of the cement and break at the smallest section. The first of these conditions includes the second, but the second does not necessarily include the first.

A paper published in Trans. Am. Soc. Mech. Engrs., Vol. IX, and also in Journal Asso. of Eng. Soc., June, 1888, describes a form of briquette which gives satisfaction in these respects. See also MUNICIPAL ENGINEERING, February, 1897, p. 76.

14. For neat cement mortar of standard consistency the mortar is too soft to be solidified by ramming. Under such conditions, any method, which will secure a briquette free from air holes, will, I think, answer. With sand mortars the question is of greater importance and some uniform method of compacting the mortar in the molds is highly desirable.

16. In the paper referred to in question 11, a set of clips is described which has been in use ever since and has given satisfaction.

The two clips are held in proper relative position by guides, so that when the briquette is inserted, it is certain to be in proper position to insure a central pull. The present manner of using these clips is different from that described in the paper, in that the guides are unclamped as soon as the briquette is in place and before any load is applied.

It seems to me that this arrangement involves the right principle. Any device for securing a central pull which depends upon the briquette readjusting itself in the clips while under load will, I believe, prove unsatisfactory on account of the friction, even if the mechanism

is otherwise suitable for the purpose.

FROM PROF. SPAULDING, OF CORNELL UNIVERSITY.

The questions sent to Prof. E. A. Fuertes, director of civil engineering in Cornell University, were referred by him to Prof. Spaulding, the assistant in charge of cement laboratories, whose answers are as follows:

1. For ordinary specifications about 10,000 meshes per square inch.

2. It is of very little, if any, value in specifications.

3. It may be of assistance in forming a judgment of Portland cement. Its use in specifications for natural cement seems unnecessary.

4. The Schumann volumenometer is usually satisfactory. Probably the modification of Professor LeChatelier is preferable.

5. Chemical analysis seems unnecessary in ordinary specifications, but may often be of value as an aid in forming a judgment of material. For important work in sea water a limit of allowable magnesia and sulphuric acid is desirable.

6. Tetmajer's method (the plunger), as used with the Vicat needle, is satisfactory.

7. It is often desirable that sand tests be made, but neat tests are usually more reliable for use in specifications.

8. The Vicat needle is satisfactory where accurate results are desired. For ordinary specifications the Gilmore needles are good enough. For sand mortar the Gilmore needles are better than that of Vicat.

9. This matter is still in the experimental stage. The ordinary test of small pats, kept under normal conditions, is probably as much as it is now desirable to impose upon cement to be used for common masonry. The hot water test, coupled with a limit of sulphuric acid, is doubtless more certain, and may properly be used on important work, particularly in sea water.

10. The tensile test.

11. I have no suggestions to offer on this point at present.

[The modified form of the French and German molds used now by both nations, seem to give more uniform breaking tests. In any case, the manner of placing the briquette in the clips has a great influence not hitherto sufficiently appreciated as bearing in great degree upon the uniformity of results.—E. A. Fuertes.]

12. The French method of making a ball of the mortar, which, when dropped, retains its form without cracking, is as good as any for hand work.

13. Uniformity in the work of different operators can only be secured by mechanical mixing. The Faija mixer is fairly good.

14. Forming the briquette under a hammer, or by a direct pressure, of a definite amount, gives the best results. For hand work, using stiff plastic mortar, and pressing into the mold with the fingers, seems most satisfactory.

15. They should be kept damp on a non-porous surface until submerged, then left submerged until time for breaking, at uniform temperature.

16. A rubber bearing surface giving small area of contact.

[Answers from others will appear in later numbers of MUNICIPAL ENGINEERING.]

THE QUESTION DEPARTMENT.

[By J. W. Howard, B. L., C. E., for MUNICIPAL ENGINEERING.]

NARROW DAMP STREETS AND ASPHALT PAVEMENTS.

What is the effect of weather upon asphalt pavements in narrow streets or alleys kept from the sun by tall buildings or otherwise? *S. G., New York.*

If such streets are kept clean, the asphalt pavements will not suffer from the elements. If filth and moisture combined stand for long periods upon such pavement in such streets, the pavement will very slowly disintegrate, especially in the gutters. Some kinds of asphalt pavements are affected more rapidly than others. Such streets should be laid with plenty of transverse and longitudinal fall to keep them dry; not only to preserve the pavement but for reasons of health, comfort and beauty. A well laid asphalt pavement made from durable materials is excellent for such streets, alleys, court-yards, etc., although there are cases where other materials are to be preferred.

CORK-ASPHALT PAVING BLOCKS.

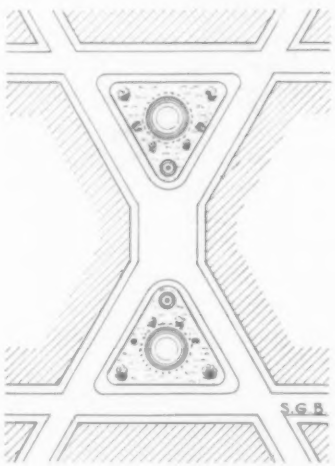
What are cork paving blocks? Of what composed? Where can a sample on a street be seen? *M. B. & Co., Elmira, N. Y.*

These are paving blocks composed principally of a ground cork cemented together with asphaltic cement, heated and under pressure and kept in compression molds until each block is cooled under water. Their size, 4½ x 2¼ x 9 inches, is about the size of a brick and smaller than a granite paving block. There are many places in stables, private driveways, etc., where they are very successful. If they do not prove too expensive they may prove an efficient street paving material. They are not slippery. A section was laid for a test on First avenue, near Thirty-second street, in New York city, during the fall of 1896. We are watching it with interest especially as there is a slight ascent there. There is much promise of the success of cork-asphalt paving blocks as a bridge flooring.

BEAUTIFYING STREET INTERSECTIONS.

In a part of Detroit not yet built up, would it be economical to reserve the intersections between two diagonal streets and two parallel ones and present the ground to the city to be beautified? The spaces are not large enough for parks. Or should we sell the small triangular spaces for whatever business might be successful there? They are too small for residence lots. *H. F. J. & Co., Real Estate.*

From your question and outline sketch the accompanying plan for beautifying the intersections (see cut) has been designed in the office of this magazine to indicate



that it would be more profitable to beautify such spaces by a little green grass and shrubbery, with possibly a fountain for beauty or for drinking, etc., than to sell such small areas; because the property on the several streets facing this beautified spot would be enhanced in value, far beyond the money that could be obtained if such spaces were used for anything but light, air and beauty. This would

be true whether these intersections were in the center of the city or its suburbs. It illustrates that it is profitable to make streets attractive.

CLEANING SEWER BASINS.

Is there no better way to clean out sewer catch basins under street corners and elsewhere? *Asst. Eng., Chicago.*

Yes, with a screw pump and even certain forms of plunger-valve pumps. It is quicker, cleaner and cheaper, although at long intervals the old disagreeable method of a man with a scoop and bucket in the basin will be needed. This is a field for invention and improvemen worthy of the thought of city engineers and others.

FLUXES OR TEMPERING MATERIALS FOR ASPHALTUM.

I notice in your magazine "wax tailings" mentioned as being used with Trinidad asphalt. What are they? I have used pitch and tar. What is generally used in mixtures for street work and for sidewalks? *A. B. Nickerson, Norwich, Ct.*

"Wax tailings" were used in connection with refined Trinidad asphalt in a pavement laid in Buffalo, N. Y., many years ago, and possibly for a little while afterward, but technically speaking they have not been used for a long time. "Wax tailings" is an expression for the heavy residuum which remains in the bottoms of the refining stills after the naphtha, benzine, illuminating oils, and possibly other things have been extracted by heat steadily raised to a higher point than 350 degrees F.

The "residuum oil of petroleum," that which remains after the extraction of the above named substances, up to and including the illuminating oils, have been removed by heat and distillation from crude petroleum, is the substance which is most largely used as a flux, tempering or softening material with Trinidad asphalt in order to make asphaltic-cement.

Asphaltic-cement is the cementing substance or matrix which combines sand, limestone dust, or whatever may be desired, and experience has shown to be best for street pavements, sidewalks, or other uses. The residuum oil of petroleum generally chosen is that which, at a temperature of about 65 degrees F., shows a density of from 18 to 22 degrees on the Beaumé scale of that hydrometer immersed in it. There are other tests not possible in this brief answer.

Certain malthas are being tried as substitutes for residuum. Maltha may be regarded as lying between crude petroleum and asphaltum. It is practically a very soft asphalt, but when used for a flux care should be taken that, while remaining soft at ordinary temperatures of the air, it should not contain volatile gases or oils, which in two or three years, if not before, will cause the disintegration of the pavement or walk, and also cause the pavement to be too soft in summer.

The use of coal-tar or the products of tar are forbidden in all standard specifications of cities with good asphalt pavements, although the use of specially prepared coal-tar in connection with walks, floors, cellars, etc., is still continued, but great care is needed in the choice and the results are generally doubtful.

BOOKS AND ARTICLES ON ASPHALT FOR PAVEMENTS, ETC.

Can you favor me with a list of works or articles treating on asphalt for pavements and other purposes, or direct me where to obtain this information? *J. F. H., Chicago.*

Standard literature on asphalt and its various uses is rare, but a large amount of valuable, scientific

and practical information is obtained in several books, but mostly in pamphlets and articles in periodicals, without mentioning the pamphlets, etc., published mostly in foreign languages in Europe previous to 1880, and omitting a large number of patents granted at home and abroad involving asphalt. The following list is one from which full information can be obtained: "Construction of Roads and Streets," Lockwood & Co., London; "Construction and Care of Streets," F. V. Greene, New York; "Asphalt and Its Uses," F. V. Greene, New York; "Asphalte," by Leon Malo, Paris; "Asphaltum," by J. W. Howard, in "Mineral Industry," New York city; "Natural Asphaltum and Its Compound," J. W. Howard, New York city; "Highway Construction," A. T. Byrne, Wiley & Sons, New York; "Lake and Land Asphalt," London, 1893; "Natural Uses of Asphalt," F. V. Greene, New York; "Pavements, Sidewalks, Roads and Bridges," J. W. Howard, Engineering Magazine, Mar., 1895; "Pavements and Roads," E. G. Love, Building Record, New York; "Street Pavements of New York," Prof. Newberry; large special pamphlet of 1889 of the Barber Asphalt Paving Co., also their specifications and other publications. Also publications of the other companies found in the advertising pages of the MUNICIPAL ENGINEERING MAGAZINE, which, although commercial publications, contain much valuable matter. Specifications of New York city are obtainable by request in person from the water purveyor. Much of the foregoing is free. All the volumes of the MUNICIPAL ENGINEERING MAGAZINE from its commencement contain more information on this subject than can be found in any other one source. Bound volumes are accessible in public libraries, and the libraries of several of the scientific schools in the east and in Chicago, or can be furnished by the publishers.

OMNIBUS OR HERDIC TIRES IN WASHINGTON, D. C.

Are the herdic tires not too narrow in our city? They are only about two and a half inches wide and the herdics carry sixteen to twenty-five persons when crowded morning and evening?

A. P. Matthews, Washington, D. C.

Yes, they should be wider. Three inches would be barely sufficient. Rounded, irregular or other steel or metal tire than one having its transverse surface parallel to the surface of the pavement over which it rolls, wears out a pavement very rapidly. No vehicle or class of vehicles should be a source of injury to pavements. The omnibuses of Washington probably do more damage to the pavements over which they are used in that city than all other classes of vehicles. An annual license charge of $500 each and five per cent. of the gross income would be a small charge to make for the roadways furnished free to the omnibus lines in Washington City.

COBBLE OR BOULDER STONE PAVEMENT IN BROOKLYN, N. Y.

An old resident has informed me that Brooklyn has about two hundred and seventy miles of cobble-stone pavements, and during the past, although most of its new pavements have been asphalt and granite, it laid some cobble. Can you furnish me with a statement of the amounts of different kinds of pavements Brooklyn has and how much it laid during the past year? Why has it used so much cobble-stone?

H. T. Sansom, Brooklyn, N. Y.

Cobble-stone was laid in the past under the false guise of cheapness, but probably the ruling factor was the influence of the politician and his friendly contractors, whose limited capacity for engineering re-

stricted them to gathering field stones and placing them close together in the form of cobble-stone pavements. During 1895, however, the improved government of Brooklyn laid improved pavements. It removed eighteen miles of cobble-stone and laid but three miles at a few points as a temporary pavement. The other kinds of pavement laid during 1895 were, granite eleven miles, asphalt nine miles, macadam eight miles, brick one-third mile.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

WHERE AUTOMATIC FLUSH TANKS ARE USED.

Can you give me a list of the cities that have automatic flush tanks connected with their sewer systems?

E. Seyboldt, Supt. Water-works, Geneva, New York.

It would be easier to give a list of those that have no flush tanks. A few of those whose names are at hand are Tarrytown, Schenectady, Glens Falls, Stamford, Amsterdam, Cortland, Jamestown, N. Y., Pawtucket, R. I., Trenton, Bloomfield, N. J., Newcastle, Pa., Canton, Alliance, Wooster, Athens, Hamilton, Dayton, Ohio, Indianapolis, Frankfort, South Bend, Ind., Omaha, Neb., and the list could be indefinitely extended. The catalogues of makers of flush tanks give many references.

MAKING THE CROWNS OF SEWERS TO GRADE AT MAN-HOLES.

What do you think of the idea of making the crowns of sewers to a grade at a man-hole where a six or eight inch pipe runs into a ten? *A. J. H.*

There should always be some extra fall in the sewer at a man-hole to make up for widening of channel which sometimes occurs for the curvature where a branch enters, and for the consequent disturbance to the flow in the main sewer and to give more force to wash away any street dirt working through ventilating man-hole covers where pans are not used to catch such rubbish. Making the crowns to grade is an easy way for the draughtsman and instrument man to set out the sewers for the sizes mentioned, but when the branch and the main line above the man-hole are of the same size it does not give the desired fall. When there is plenty of fall a standard man-hole drop, for each size of pipe if desired, is quite as convenient for the draughtsman or designer, and the instrument man usually sets out the line from the given elevations, so that it makes little or no difference to him.

WEIR MEASUREMENTS OF WATER.

Will you please inform us how much water the following weir measurements would indicate as passing: Weir 4 ft. long, depths at edge of weir, $\frac{25}{64}$ in., $\frac{31}{64}$ in., $\frac{44}{64}$ in., respectively?

James Porter, Greenfield, Mass.

The formulæ for flow of water over weirs have not been determined for the measurements of depths of water at edge of weir, on account of the practical impossibility of obtaining an exact measurement of the depths of water on this line. Probably the best formula would be one derived for this method of measurement if it were not for the practical difficulties. The dimensions of the channel behind the weir, or the velocity with which the water approaches the weir, and the height of still water above the crest of the weir must also be known.

Francis' formula for the discharge of water over weirs is the simplest, but is strictly applicable only for weirs more than four feet long and more than 0.4 feet (4.8 inches) height of still water above crest of weir. It will give results

good enough for ordinary estimates, however, for shorter weirs and for somewhat less depth of water. In the example given the depth of water is too small for good results. The weir should be shortened to say one foot in length to give a good depth of water.

Let b = the breadth of the weir in feet (4 ft. in the question).

H = the height in feet above the crest of the weir of still water in the pond, several feet from the weir.

The discharge in cubic feet a second will then be closely approximated by multiplying 3.33 b by the cube of the square root of H, *i. e.*, $q = 3.33\ b\ H^{\frac{3}{2}}$.

If the weir is short and the edges at the ends are sharp, 0.2 H should be subtracted from the width b. This formula assumes that the edge of weir is sharp and straight and set exactly level, and sides sharp, straight and vertical. If depths of water are slight, great errors in discharge will result from slight errors in measurement of H. With a hook gauge the measurements can be made to 0.0002 of a foot, if necessary. Approximations can be made by setting a stake back four or five feet from the weir at exactly the same level as the crest or edge over which the water flows. The depth of water over the stake will be the value of H in the formula, and this depth can be measured within a few hundredths of an inch, with a sharp-edged, flat scale, the sharp edge being turned up stream if there is a perceptible current. Measurements made at the weir crest are liable to still greater errors, and an error of $\frac{5}{64}$ inch is not remarkable. The difference in discharge between depths of $\frac{26}{64}$ and $\frac{31}{64}$ will be about 30 per cent. If the measurements given were to still water, the discharges, according to the formula, would be 0.083, 0.1065 and 0.18 cubic feet a second respectively, if the allowance for contracted ends is not made. This allowance would diminish the quantities, but the actual height to still water is probably enough to more than counterbalance this deduction, so that the actual discharges are somewhat greater than these figures would indicate.

FORM OF REPORT FOR GAS, WATER AND ELECTRIC LIGHT PLANT.

Please send me if you can some forms of report suitable for a private company operating the gas, water and electric light plant under one management.

W. W. Moore, Columbia, Tenn.

The following is an attempt to provide such a form. Some may find it too full and others not full enough, but it contains most of the points which such a report should contain. Criticisms upon it are invited from any one interested in securing as complete a form as can be obtained when the varying needs of plants are considered.

Monthly report of.....
.....18...

(Following is the column of items, a second column would contain the amounts for water, a third for gas, and a fourth for electric light.)

RECEIPTS.

Regular monthly bills.
Special bills, (lines for permits, building purposes, gas stoves, lamps, coke and tar, etc., as required for the special case.)
Connections and improvements.
Sales of material.
Rent.
Sundries.
Delinquents' accounts paid.

DISBURSEMENTS.

General Maintenance.
Salaries.
Office and telephone rent.
Stationery, printing and postage.
Advertising.
Insurance.
Taxes.
Livery and stable.
Traveling expenses and car fare.
Labor and inspection.
Interest and exchange.
Expenses of manufacturing.
Wages.
Fuel.

Oils.
Tools and Repairs.
Repairs to pumping or manufacturing plant.
Other supplies.
General repairs.
Pipe or line systems.
Hydrants, valves, lamps.
Reservoir, stand-pipe, gas holders.
Real estate and buildings.
Construction of Extensions.
Connections.
Meters.
Pipes, wires and poles.
Hydrants, valves, gas lamps, electric lamps.
Tools and repairs.
Gas stoves and incandescent lamps.
Other supplies.
Wages.
Miscellaneous.

CASH ACCOUNT.

Amount of cash on hand at last report.
Amount of cash received during month on above accounts.
Amount of cash received during month, other sources.
Total cash to be accounted for.
Amount paid on above accounts.
Amount paid for rebates.
Amount paid for legal expenses.
Amount paid for bills payable.
Amount paid for ———.
Amount paid for ———.
Amount remitted to ———.
Amount on hand at date.

MANUFACTURING ACCOUNT.

Product on hand at last report.
Pumped or made during month.
Registered by consumers' meters.
Consumed at works and office.
Leakage and unaccounted for.

ON HAND.

Coal and kind on hand at last report.
Coal and kind received during month.
Cost per ton.
Coal and kind used during month.
Coal and kind on hand.
Production per 100 lbs. of coal.
(Similar set of items for coke and for tar or other products of manufacture if desired.)
Ashes, weight of.
Average pressure.
Duty of engines, ft. lbs. per 100 lbs. of coal.
Duty of boilers, lbs. water evaporated per lb. of coal.
Oil consumed. Cylinder, gallons.
Machine, gallons.
Kerosene, gallons.
Waste, lbs.
Average candle power of gas.

CONSUMERS' RECORD.

No. consumers at last report.
No. added during month.
No. cut off during month.
No. at date.
Gross amount of bills for month.
Discounts and rebates for month.
Net amount of bills for month.
Amount collected during month.
Total amount outstanding.
Amount received from city during month.
Total amount due from city.

METER RECORD.

No. $\frac{3}{8}$ in. meters in use.
(Additional line for each size of meter.)

Sewage Pollution in Connecticut. The legislature of the state of Connecticut is discussing the appointment of a commission to investigate the pollution of the rivers of the state and report to the next legislature, with little prospect of the passage of the bill. Many of the streams in the state are now seriously polluted, and the waters of Long Island Sound at the mouths of the principal streams are not in good condition. The problem is not quite the same as that in New Jersey or that in Massachusetts, and the smaller cities of the state and the streams have suffered from incompetent engineers and lack of state supervision. The seeming objection of the legislature to spend money enough to secure adequate expert study of the entire problem has been duplicated by some of the cities with reference to their particular problems. The absence of any very large city doubtless has its effect upon the character of legislation on the subject, as the difficulty is not anywhere sufficiently concentrated to demand heroic measures of relief.

Proposed Filtration of Water at Albany, N. Y. The city of Albany takes most of its water supply from the Hudson river, in front of the city, where it is subject to pollution from the city and from cities and villages above during ebb tides, and from Albany sewers during flood tides. Many attempts have been made at different times to obtain water from other sources, but investigation has shown the inadequacy of proposed supplies or their excessive cost, or trial has resulted in failure. It is now proposed to filter the river water, and Mr. Allen Hazen has recently made a report to the water commissioners recommending sand filtration, according to the system so successful in London, England, Lawrence, Mass., Hudson and Poughkeepsie, N. Y., and other places at home and abroad. He estimates the cost of a plant with a capacity of 15,000,000 gallons a day, on the flats near the river, at $478,000, and the cost of operation at $16,000 a year. The water would be taken from the river, where it would be less subject to pollution by Albany sewage than at the present intake, lifted by centrifugal pumps to the filter beds, and then pumped to the distributing reservoirs by the present pumping machinery. Mechanical filtration would cost $299,000 for installation and $22,150 a year for maintenance. A public meeting was held March 4, at which the subject was discussed by the prominent professional and scientific men of the city, and the audience was almost unanimously in favor of filtration, with a decided preference for natural sand filtration, although the estimates indicate that it is somewhat more expensive. The city is subject to winter epidemics, which are almost always traceable to polluted water supply. The fact of pollution and its amount have been so often proved, and the evidence of the origin of epidemics is so clear, that the city has long been

chafing under the necessary delays, and has made some very expensive experiments, none of which have been successful. The high measure of success attained in several places by sand filtration gives the citizens hope that the experiment on this line will be a success.

The Chicago Intercepting Sewers. The experts whose report was discussed in this department last month are at variance regarding the size of the main intercepting sewer, two members of the commission, Mr. Smith and Mr. Benzenberg, contending for a sewer 13 feet in diameter, providing for a rainfall averaging one-fourth inch an hour, and three considering one 9 feet in diameter sufficient, providing for one-eighth inch rainfall an hour. Overflows into the lake are provided in both cases, and it is evident that with the smaller sewer these overflows will be called into action much more frequently than with the large sewer, with consequent greater effect upon the purity of the water supply and at more frequent intervals.

Passaic River Pollution. The pollution of the Passaic river in New Jersey by the sewage of Paterson, Passaic, Orange, Newark and other cities and towns with a present population of over 350,000 has become so great as to produce serious nuisance. A commission appointed a year ago has recently made a report to the legislature giving the facts in the case, a recommendation of a remedy and a draft of a bill to enable the remedy to be applied. The cities formerly using the lower Passaic for water supply have now transferred their sources of supply to the upper river or to other sources, so that the proceeding is taken, so far as the lower river is concerned, only to diminish the nuisance to adjoining territory. After detail of the present conditions the commission and their engineers present a plan for an intercepting sewer beginning in the city of Paterson, with a diameter of three feet, increasing to seven feet when it enters Newark, where a pumping station is located, to raise the sewage to a higher level, whence it flows in a sewer which gradually increases to ten feet diameter at the outlet in Newark bay, where another pumping station will ultimately be located to manage the sewage at the outlet. The sewer is designed to accommodate a population of 1,500,000, which is expected in the district by 1930, will cost, complete, $6,500,000, and will cost annually for maintenance, from $127,000 at its completion to $300,000 in 1930. The possibility that the sewage will some day seriously pollute the waters of Newark bay is considered, and various methods of treatment are suggested, but the selection of a method is left until that contingency arrives.

Were the problem located in Massachusetts the construction of the sewer could be undertaken by the state in the manner followed in Boston and its suburbs, but the constitution of the state of New

Jersey prohibits such action by the state as well as special legislation on any subject. The commission therefore recommends that the watershed of each river of the state be erected into a sanitary district upon report of commissioners, appointed for the purpose, that the river is unduly polluted, and that commissioners appointed by the governor be given charge of the district to prevent pollution of the stream and its tributaries by proper rules, regulations and inspection, and to construct the necessary sewers and sewage disposal plants and assess the cost thereof upon the corporations and individuals benefited. The lower Passaic would be benefited by the construction of the sewer, and the upper Passaic, now used as a source of water supply, would be benefited by the protection from pollution from isolated sources. The importance of immediate action is urged, as the conditions are rapidly growing worse, and the time required to construct the sewer for the lower Passaic will be considerable. The disadvantages of the method of government by commissioners are hinted at, but, under existing conditions, no better system is available. Much of the district in question is within two hours of New York and is increasing in population at a rate of about 40 per cent. in ten years.

The present discharge of sewage into the river is estimated at 70,000,000 gallons a day, and the minimum flow of water in the river is but little more. Sewage discharged into the river at tide-water is not readily removed during ebb-tide, and is not sufficiently diluted. The area is becoming so thickly settled that adequate methods of sewage purification for each individual corporation will shortly become impossible. The current in Newark bay near the proposed outlet is sufficient in volume and rate of flow during a considerable portion of the tidal flow to readily take care of the sewage for many years. All the arguments except that of initial expense point to the system proposed. Much of the sewer must be built if the individual cities take care of their own sewage, but would be of smaller size, so that the additional expense due to the system is only that due to the increase in size. This would be offset in large part by the saving in sewage disposal plants.

Sources of Water Revenues. In continuation of the articles in this department on the proportion of the expenses of the water supply to be borne by various interests may be given the suggestions of the superintendent of public works of Columbus, Ohio. He considers that the first cost of the water plant should be borne by the city at large, including both principal and interest. That is, the cost of first construction and extensions should be raised by general taxation, or, if bonds are issued, the interest and sinking fund should be raised in that manner. The private consumer should pay all the expenses of management, maintenance, re-

pairs and a reasonable interest on that part of the plant devoted to his interests. The city should be treated as a private consumer so far as water consumption for public purposes is concerned.

When many water systems are considered, it will be found that the variations in relative cost of construction and of maintenance are so great that the proportions borne by the city at large and by the water taker will vary between wide limits, so that, while this distribution of the expense may be very equitable in one case it may be far from it in another, and in either direction. The distribution of the sinking fund and interest charge in proportion to the cost of a plant for domestic and manufacturing service only and the added cost for fire purposes, and the distribution of cost of maintenance in proportion to amount of water used, with a minimum charge for each class of service, with due attention to saving in insurance rates and fire losses, and to special conditions, seems to be based upon more generally equitable principles than the system suggested. The superintendent makes a strong argument for the application of meters to all services, that waste may be prevented and that a definite basis for charges may be secured. Water is and should be as free as air, but it can not be delivered to the house as cheaply, and what the consumer pays for is not the water but its delivery. The cost of delivery after the pipes are laid down is proportional very nearly to the amount delivered, and, with one exception, should be paid for at rates proportional to the amount delivered. The first cost of pipes is a very nearly constant charge and should be met in part by general tax, and in part by a fixed minimum charge for water. Another reason for making a fixed minimum charge for water, covering an ample supply for ordinary use without waste, is the desirability of removing the temptation from small souls to save a few pennies by reducing the consumption of water below a quantity sufficient for ordinary cleanliness of person and habitation.

Water Supply of Columbus. Some years ago the city of Columbus, Ohio, constructed long filter galleries in the gravel beds along and under the Scioto river from which to obtain its water supply. The water thus obtained was clear and quite pure, but hard, and the problem of water supply was considered solved. Time has shown, however, that a sufficient supply can not be obtained from the filter galleries in times of drought and resort must then be had to the river direct, with immediate complaint from consumers regarding the quality of the water. Even this source under the storage conditions existing was scarcely sufficient last summer, and the water question is again a most important one. Professor Edward Orton, Sr., recently read a paper before the Columbus

Engineers' Club, in which he detailed the conditions and outlined an excellent plan for remedying the present defects. He showed that the city has practically no sufficient source of supply within reach but stored river water, that the Scioto river is sufficient in size, is the least polluted by sewage of any sufficient stream, and has ideal locations for impounding dams. The quality of the water would be improved by storage, but satisfactory quality can only be attained by filtration through sand.

The superintendent of public works also recommends a dam in the river for storage purposes. For the sake of saving some immediate expense, the city council appropriated money to purchase two small existing dams. These dams are not where they would be of value, except as receiving basins and have capacity for a supply of only a week or two. Many small dams would be necessary to provide the storage capacity of one large dam, and would cost much more for construction and purchase of flooded land, and preparation of the same for use. The city council does not seem to have confidence in its local engineers, though some of them are well known in their profession, nor is it willing to incur the expense of expert advice from other localities, so that it is likely to waste some money in unscientific experiments. This procedure is not peculiar. One of the greatest defects in the American system (or lack of system) in city government is the persistent ignoring of expert assistance in all lines of municipal activity. Election to office is elevation to the position of expert in engineering law, accounts, architecture or whatever may be the subject under consideration.

Comparative Cost of Coal And Oil as Fuel For Water-works.

The report of the water commissioners of the city of Detroit for the year 1896 is received, in marked exception to the usual procedure, whereby, even if the report is made on time, the printing of the report is delayed for several months. The report is of much interest for its valuable discussions of several engineering questions of vital importance to the management and economical operation of water-works.

An excellent opportunity to compare the value of various fuels was afforded by the change from fuel oil to hard coal in May, and a second change to soft coal on October 1. Fuel oil during the first four months of the year cost 2.18 cents a gallon, and the average cost of pumping 1,000,000 gallons 100 feet high was $2.55. During May both oil and coal were used, so that this month is omitted from the comparison. In the four months, June to September, hard coal costing $4.37 a ton was used, and the average cost of pumping was $2.31. In the last three months soft coal costing $2.60 a ton was used, and the average cost of pumping was $1.43. The comparison would be still less favorable to oil as compared with

coal, and to hard coal, as compared with soft coal, if proper account were made of the fact that about one-third of the water used in the first four months was pumped by the new engine, about one-fourth in the four months when hard coal was used, and none in the last three months. The new engine is reported to be about 20 per cent. more economical than the others.

The table from which these figures are deduced is rather tantalizing in that it gives the information, but not quite in sufficient detail to make a close comparison; therefore, the figures are probably not accurate within a few cents. The data of work done would indicate on their face that 100 pounds of hard coal are equivalent to 11 gallons of oil, but when proper account is made of the difference in efficiency of pumps, the 100 pounds of coal are practically equivalent to 10 gallons of oil. The report does not state the additional cost of handling coal, and the additional labor cost in the comparison, so that the above advantageous showing for coal must be discounted somewhat for the extra cost of handling coal and ashes.

The above figures are deduced from a table on page 11 of the report, and have been as carefully checked as the fullness of the data will permit. On page 97, it is stated that the cost of pumping one million gallons of water one hundred feet high at the given prices of fuel is $2.78 for oil, $2.40 for hard coal and $1.31 for soft coal. These figures agree fairly well with those deduced from the table if the corrections are made for the differences of efficiency in pumps, and would then represent the cost if the pumping had all been done by the old engines. The exact data from which these latter figures are obtained are not given. It is stated on page 97 that the total cost of pumping per million gallons was $4.02 in 1896, which is greater than in 1895 on account of the high price of fuel in the first nine months of 1896. This statement is not borne out by the figures for cost of fuel given on page 95, from which it is deduced that fuel cost $2.19 per million gallons in 1895, and $2.35 in 1896, and the figures on page 26, from which it is deduced that the total cost of pumping was $3.52 per million gallons in 1895 and $4.02 in 1896. The increase due to fuel is therefore 16 cents per million gallons, and the increase due to other causes is 34 cents. The fuel cost in 1895 should be 7.6 per cent. higher than in 1896 on account of that percentage of decrease in pressure in 1896, so that, reduced to the standard of one million gallons, one hundred feet high, the ratio of cost of fuel to other items of cost of pumping would be as 16 to 26 approximately. Increase in labor, cost of handling fuel and in other items therefore accounts for more of the difference in total cost than does increase in cost of fuel.

Related items are not well collected in the report and some desirable details are thus omitted.

For example the figures in this article are found part on pages 11, 12 and 26 of the general superintendent's report, and part on pages 95, 96, 97 of the report of the chief engineer of the pumping station. Other points, on which information, not usually found in such reports, is given in detail, will be discussed hereafter.

CURRENT INFORMATION.

VALUABLE INFORMATION FROM A PROGRESSIVE CITY ENGINEER.

Among the official reports deserving special commendation it affords us pleasure to mention that of Mr. A. D. Thompson, city engineer of Peoria, Ill., who has contributed much to the solution of problems in municipal work. His fifth annual report is pleasing in style and contains much of general interest, besides setting forth statistical information of local value.

The report shows that in 1896 the cost of brick pavements, on a foundation of six inches of concrete, ranged from $1.32 to $1.48½ per square yard—3.9 cents more than the average in the previous year—and on an 8-inch concrete base, from $1.51 to $1.52. Asphalt, on a 6-inch concrete foundation, cost from $1.84 to $1.90 per square yard, a reduction of about 16 cents per square yard from the average price of the previous year.

Mr. Thompson says that he found the following alterations in his paving specifications to be valuable changes:

1. Increase of alley foundations from four to six inches in thickness.
2. The use of four parts of broken stone in the concrete, instead of five parts.
3. Brooming surface of concrete to a smooth surface.
4. Requiring a sand cushion on brick pavements two inches, instead of one inch, in thickness.

Six inches of concrete has been the minimum thickness used in both street and alley paving. This is an increase of two inches in thickness in alleys over that used during the two previous seasons, and the results obtained have been much more satisfactory.

The use of four parts, instead of five parts, of broken stone, ranging uniformly in size from one-fourth inch in two and one-half inches, has given a more solid and permanent concrete. There has been no difficulty in bringing mortar to the surface by proper tamping, which has materially decreased the amount of grouting formerly found necessary and has produced a stronger concrete. The proportion of one part cement, and one and one-half to two parts sand and four parts broken stone, of the above size, appears to give the best results in street concrete work with a natural cement.

Brooming the top of the concrete to a smooth surface and using a two-inch sand cushion have been of material assistance in procuring smoother brick pavements.

The concrete laid in continuous sheets has shown a tendency on several streets to buckle and form ridges in the pavements, caused by the expansion of the concrete. The specifications for the coming season provide for the concrete to be separated at each three hundred feet of length by a space one inch wide to allow for this expansion and prevent the formation of such ridges. This is the only change considered desirable in the brick paving specifications.

In addition to this change the asphalt specifications have been modified, so that the cost for grading and paving are made separate items, the same as in brick paving. The previous specifications required the cost of grading to be included in the cost per square yard of pavement, but it is only just that both pavements should be placed on the same basis, in order that the comparison may be made between like items for each class of paving and serve as a guide to the property-owners in selecting the pavement desired on any street.

On the subject of asphalt paving Mr. Thompson says:

"Under the present method of laying asphalt pavements in this city, a coat of asphalt one-half inch in thickness, known as a cushion coat, is first laid on the concrete foundation and rolled, upon which a wearing surface two inches in thickness is laid and thoroughly compacted. The cushion coat is placed to protect the concrete and is composed of the same ingredients as the wearing surface, but contains from 2 to 4 per cent. more of asphaltic cement. The wearing surface is laid hot and compacted by a heavy roller, so that the two coats are bonded together and compose the pavement two and one-half inches thick.

"The co-efficient of expansion of an asphalt pavement has not been definitely determined, but the investigations indicate

that it is somewhat greater than that of wrought iron. The sudden and extreme difference in temperature to which the pavement is subjected in this climate cause enormous expansive and contractive forces to be exerted in an asphalt sheet a mile or so in length. The cohesive strength of the mixture is not sufficient to resist the tension caused by low temperatures and the pavement must necessarily crack. Again, in high temperatures the asphalt expands and increases in length, forming ridges and rolls. These faults create dissatisfaction among the citizens paying for the improvements, are annoying to the public using the streets, and detrimental to the pavement.

"I believe the method of laying the pavement as above described is mainly responsible for these faults—the smooth surface of the concrete foundation offers no resistance to the movement of the equally smooth wearing surface resting upon it. To overcome the difficulty, I would recommend that the specifications be altered, so that the pavement shall consist of a binder coat one inch in thickness and a wearing surface two inches in thickness. This binder coat is an asphaltic concrete composed of crushed stone or gravel comented together with asphaltic cement. Containing a large amount of cementitious material, it adheres strongly to the concrete foundatıcn and asphalt wearing surface between which it lies and binds them firmly together, offering a strong resistance to any movement of the asphalt, and the expansive and contractive forces are exerted in trying to overcome this resistance. This construction has been generally adopted by the eastern cities, with satisfactory results. The cost of such a pavement is about 13 cents per square yard more than the pavement constructed under the present system."

Referring to steep grades Mr. Thompson says that on such streets pavements composed of brick with rounded corners laid closely together have proved rather slippery. "A special brick was designed for use in such cases, which is 3x4x9 inches in size, with all edges, except the ends, beveled three-eights of an inch, thus leaving a space between the bricks at the surface about one inch in width. Another fault with brick pavements on heavy grades in the past has been the washing out of the sand filler by the rains. To prevent such action the interstices on streets having grades of more than 4 per cent. which were paved with brick the past season have been filled with a thin grout composed of imported Portland cement and sand, mixed one to one. The special brick with cement filling was used on the Hamilton street hill, and it is the intention to use such construction on all streets to be paved with brick where the grade exceeds 4 per cent. The cost of this construction is slightly higher and it requires more careful work, but is far superior to the ordinary brick pavement for such cases." Mr. Thompson thinks that no street should be paved with asphalt which has a grade of more than 4 per cent.

Peoria has had trouble over the flushing of its sewers. The city has 255 flush tanks, constructed at a cost of $15,000, which would use about 65,000 gallons of water per day, including possible leakage, if set to discharge once in twenty-four hours. The tanks are not connected with the water mains because of a disagreement with the water company, but are lying idle while the flushing is performed by a gang of men, who turn the water into the tanks with a hose connected with the hydrants. This method is costly and inefficient, and the flushing by such means is not sufficiently frequent to prevent deposit in the small sewers or to prevent them from becoming unsanitary under possible conditions favorable to the propagation of disease, though the sewers have thus far been maintained in a sanitary condition.

The standard thickness of curb formerly used in Peoria was four inches, but this has been abandoned and nothing is now used but five and six inch curbing. The additional cost is about 5 cents per lineal foot, but it is more satisfactory.

The municipal testing laboratory, it is stated, is now equipped with everything necessary to test all materials used in public improvements, excepting asphalt. All brick, cement and sand intended for use on public improvements have been tested. Refined asphalt, asphaltic mixture and other ingredients of asphalt pavements are forwarded to an expert to determine whether or not they meet the requirements of the specifications. This method is faulty, Mr. Thompson says, for various reasons and he asks an appropriation of $850 to equip the laboratory for this work.

The pamphlet also embraces a number of statistical tables, together with reports of W. O. Clark, commissioner of public works, and Joseph M. Davis, street superintendent.

NARROW PAVED ROADWAYS FOR MINOR RESIDENCE STREETS.

There has recently been much discussion in Kansas City newspapers of narrowing the paved roadways of the less important and least traveled residence streets. This is urged because it will greatly reduce the expense of constructing pavements and cleaning them, and will thus more rapidly expedite the permanent improvement of streets. The parking of such streets will also add much to their appearance, and this will also be more pleasureable to the residents, especially during the summer months. The plan applies only to what are called the "side streets," and does not embrace the main thoroughfares. Col. F. V. Greene of

New York sent a letter to the Kansas City authorities commending the plan and offering suggestions for carrying it into effect. He says:

"I think the idea is an excellent one, and can be carried out in such a way as to secure very handsome streets for Kansas City at a great reduction in cost to the property-owner as compared with present methods.

"In the great city of New York the residence streets, even in the heart of the city, contain roadways of only thirty feet from curb to curb. For the outlying streets of Kansas City I feel entirely confident that a roadway of twenty feet would be ample for all present requirements.

"My suggestion is, however, that the plans should be so made as to provide for an increase from twenty to thirty feet in the roadway if at some subsequent date the traffic should require it. The plans should be so made that this increase can be effected without leaving any break in the roadway surface.

"I understand that the residence streets of Kansas City are some of them sixty feet in width from house to house, and some of them fifty feet.

"I would suggest that the space between the curb stone and the house line, which in one case is twenty feet and in the other is fifteen, should be laid with a five-foot sidewalk, and a grass plot on each side of this. If trees should be planted in the space between the flagged sidewalk and the curb stone the result would be a very handsome street imporvement.

"A large number of streets in Washington have been constructed on this principle, and have done more than anything else to add to the appearance of the streets of Washington—the handsome appearance of which is known all over the country.

"If, at some subsequent time, the traffic should increase so as to require an increase of the roadway from twenty to thirty feet the foot traffic on the street would probably increase in the same proportion, and the entire space between the curb line and the house line would be needed for a flagged sidewalk.

"In order to make the change at that time it would only be necessary to take up the curb stone and move it back five feet, placing the inner edge of it next to the flagging and extending the flagging to the house line. These plans are so drawn that the crown or curvature of the street could be carried out to the new curb line without making any break in the regularity of the street surface.

"With the present methods of repairing and joining asphalt pavements the new could be joined to the old pavement in such a manner that the joint could never be detected.

"In these plans for the narrow roadway the depth of the curb shown above the pavement is only three inches, which is quite sufficient for the small traffic which is now carried on these streets. In the proposed enlargement, when the traffic is sufficient to require it, the depth of gutter, or amount of curb shown above the pavement, is increased to seven inches.

"F. V. GREENE."

This plan is equally applicable, of course, to other cities, and where practicable it will save much expense for paving.

MR. NORTH'S SAND SPRINKLING BOX

E. P. North, water purveyor of New York City, has designed a sand box for holding sand to be used for sprinkling steep grades on the streets paved with asphalt in wet and frosty weather when they become slippery. The box is 50 inches high, 20 inches long and 10 inches wide, and has a semi-cylindrical cover. The boxes, which may be made of cast iron ¼ inch thick, or steel ⅛ inch thick, are to be painted inside and out with one coat of red lead and two coats of dark green.

PUBLIC WORK BY DAY LABOR INSTEAD OF BY CONTRACT.

The bill of Assemblyman Abell, to allow the public works department of New York City to have paving work done by the day instead of by contract, will be given several public hearings when it comes before Mayor Strong. The bill is thought to be directly against the interests of the tax-payers. The cost of erecting a plant for the mixing of asphalt would be enormous, and after it was built the city could not do the work as cheaply as the contractors, for the law requires the city to pay laborers $2 a day for eight hours' work, while the contractor can hire men for 15 cents an hour. In other respects the city would be at a great disadvantage, and the result would almost certainly be a largely increased cost of pavement construction, and probably greatly inferior work. The bill can hardly be regarded seriously.

PURCHASE OF TURNPIKES IN NEW JERSEY.

A bill was passed at Trenton, N. J., March 11, which will, if it becomes a law, abolish all the turnpike roads in the state. The bill provides for the acquirement by the state and various counties of all such roads under certain conditions, upon the presentation of a petition signed by the owners of two-thirds of the land and real estate fronting or bordering on any turnpike road praying that the road may be acquired for free public use. The Governor shall appoint five commissioners from the county through which the road runs, to estimate the value of the turnpike and the franchise of the corporation owning the same, upon ten days' notice. The commissioner is to report to the state road commissioner, who may ratify the same and report to the Board of Freeholders, who shall purchase the road. One-third of the

cost shall be paid out of the State road appropriation, provided the amount shall not be in any one year more than $20,000. The turnpike roads acquired in any county shall not exceed one-fourth of 1 per centum of the taxables of such county. The Circuit Court Judge of the county is empowered to appoint three commissioners to assess benefits for the purpose of making up the balance of the cost after the state appropriation is secured. The rapid construction of new macadamized roads interferes seriously with the operation of the old turnpikes, so that they are no longer on a paying basis.

METHOD OF CLEANING ASPHALT PAVEMENTS IN NEW YORK.

A new method for cleaning asphalt pavements has been introduced in New York City. A gang of men, armed with wooden scrapers having blades of rubber, which are called "squeegees," form in line across a street; the men at the crown, who are a little in advance of the others, push their "squeegees" along the pavement for several blocks without stopping, and in this way eight men are enabled to clean more than a mile of pavement an hour. It is said that notice has been taken of the fact that horses do not slip when passing over the pavement when it is cleaned in this way.

MUNICIPAL OWNERSHIP OF WATER WORKS.

The Citizens' Reform Club at Dubuque, Ia., is considering the question of municipal ownership of the water works system, and a committee has been appointed to gather data and report. The Citizens' Reform Club appointed a committee in 1894 to investigate in ten cities similar in size and location to Dubuque, Ia., and report on the manner in which plants are owned, operated, amount invested, rates paid by consumers, etc. The cities selected by the committee were Winona, La Crosse, Moline, Rock Island, Sioux City and Aurora, having municipal plants, and Clinton, Davenport, Burlington and Quincy, where the plants are owned by corporations. The report of the committee at that time on plants under municipal control was as follows:

Aurora, which owns its own plant, has a population of 25,000. The works are valued at $282,000. It has 43 miles of mains, 2,320 caps and 415 hydrants. The operating expense is $7,800, and consumers pay $4 per family.

Winona, population 25,000, has a plant valued at $275,000, with 30 miles of mains, 750 taps and 243 hydrants. The operating expenses are $15,000, and consumers pay $3 per family.

Sioux City, population 40,000, owns its own works, valued at $184,000. It has 40 miles of mains, 3,200 taps, and 210 hydrants. The expenses are $25,000, revenue $42,000, and consumers pay $6.

La Crosse, population 32,000, owns a plant which cost $250,000. With 32 miles of mains, 2,600 taps and 304 hydrants, the operating expenses are $17,000; revenue, $25,000. Consumers pay $5.

Moline, population 15,000, has a plant which cost $150,000. It has 14 miles of mains, 800 taps and 188 hydrants. The cost of operating is $8,000 and revenue $11,000. Consumers pay $4.

Rock Island, population 20,000, owns works which cost $250,000. It has 22 miles of mains, 1,400 taps and 177 hydrants. The operating expenses are $12,000 and revenue $24,000. Consumers pay $4 per family.

Davenport, owned by a private corporation, had 45 miles of main, 2,500 taps and 449 hydrants; the city paid $17,000 for hydrants and consumers $6 per family. Clinton had 32 miles of main, and 1,400 taps; the city paid $9,500 for 200 hydrants and consumers $9 per family. The consumers in Burlington pay $4. Dubuque pays $19,326 for 300 hydrants and consumers pay $8 per family.

The committee appointed this year to report consists of George Salot, John Pickley, D. W. Rand and H. A. Guiffke.

ANALYSIS OF WATER IN ILLINOIS.

The University of Illinois has been conducting a survey and analysis of the water supplies of Illinois for the purpose of ascertaining the character of the supply. The analysis is being conducted by Professor A. M. Palmer, Professor of Chemistry in the University at Champaign. Water from 156 towns and 68 counties have been tested at the laboratory, and the general conclusion reached is that the use of water from wells be discontinued, or that the water should be thoroughly boiled before drinking.

REGULATION OF STREET RAILS IN NEW YORK.

A bill has been introduced in the New York General Assembly proposing to make it unlawful after July 1, 1898, for any surface railway company to run passenger cars over any rail the width of which is greater than its perpendicular depth; to maintain any self-acting automatic lever switch or switch-box on a paved street or any switch which projects more than one-half inch above the tread of the adjacent rail, or excepting as to the flange-way or flange-groove, is depressed more than one-half inch below the adjacent tread of the rail. The bill also provides that where there are more than two pairs of rails in any public street, the tracks in excess of this limit shall be taken up, nor shall switches be maintained for more than two tracks. Officers in charge of paved streets or highways are

empowered to determine the transverse section of the rail and paving in connection with it. It is understood that the bill is indorsed by Water Purveyor North, who has charge of street construction in New York City.

AN INTER-MUNICIPAL SYSTEM OF WATER WORKS.

An important question which may be considered in the near future in Ohio is that of securing water for the municipalities. As the state becomes more thickly populated a pure water supply is more difficult to find and the inaccessibility of many towns to water of any kind has led to the proposed establishment of an inter-municipal system of water works, with Lake Erie for the reservoir, from which water will be secured to supply the towns and villages. Some of the estimates and data which have been collected regarding towns which lie along the C., H., V. & T. railway are as follows:

Cities and Towns.	Elevation above Lake Erie.	Distance from Lake Erie.	Population.
Toledo	13	00	81,434
Le Mayne	65	12	200
Bradner	120	24	218
Fostoria	270	35	7,070
Alveda	278	43	200
Carez	240	50	1,605
Up. Sandusky	275	60	3,572
Fowler	327	...	....
Morral	335	75	100
Marion	378	78	8,327
Owens	384	83	100
Prospect	345	88	830
Radnor	380	93	300
Delaware	354	100	8,024
Hyatts	360	105	65
Powell	345	109	137
Elmwood	271	114	136
Olentangy	249	116	25
Columbus	190	124	88,150
Groveport	165	136	578
Winchester	196	140	633
Carroll	262	147	293
Lancaster	281	156	7,555
Sugar Grove	196	163	275
Logan	155	174	3,119
Un. Furnace	175	181	100
Starr	202	186	20
N. Plymouth	203	188	200
Creola	156	195	20
McAuthur	157	200	888
Hamden	148	206	622
Wellston	165	208	4,377
Coalton	145	213	1,459
Jackson	125	218	4,230

The Columbus elevation has been substituted by that at Valley Crossing.

FAVORABLE TO AMERICAN PORTLAND CEMENT.

The various municipal departments in Philadelphia may not be permitted to specify "foreign and imported cements" in asking proposals for work requiring Portland cement in the future. An ordinance has been approved by the committee on municipal government recognizing the merits of American Portland cement, and requiring that the requisite strength and fineness alone shall be specified in advertising for bids on cement.

ASPHALT AND BRICK AT MACON, GA.

Difference of opinion between the citizens and the council at Macon, Ga., regarding a choice of materials for street paving is likely to result in the establishment of a vitrified brick manufacturing enterprise. The preference of many citizens is for asphalt, while that of the council is for vitrified brick. The main objection urged by the opponents of asphalt is its cost, but those advocating it contend that the city can better afford to pay 50 per cent. more for asphalt than to experiment with brick. The difference in cost between the two has been shown, since the discussion began, to be about 20 cents per square yard, which, it was supposed, would bring asphalt into favor. The disposition of the council to favor brick has given encouragement to a project for starting a brick manufacturing plant, thereby creating a home industry and keeping at home the $400,000 that is to be spent in paving the city's streets. It is claimed that the clays in and around Macon are suitable to the manufacture of paving brick, although a doubt on this point seems to exist in the minds of many of the citizens, who are opposed to accepting home-made brick merely because they are a local production, regardless of their being up to the standard in quality. Mr. W. P. Stevens of the Henry Stevens's Sons' company of Macon, who has made a study of clays, not only in the United States, but in England, Scotland and other portions of Europe, says: "We have clays about Macon that if properly handled, will make as good vitrified brick as are produced in any place in the country. I believe that with proper manipulation our clays will make a vitrified brick that wil offer as small percentage of wear as any that are produced."

ASPHALT SPECIFICATIONS IN PITTSBURG.

The asphalt investigating committee, which was appointed about one year ago, in Pittsburg, Pa., to investigate the merits of Trinidad and Bermudez asphalt, but the scope of which was subsequently extended to other asphalts, has completed its work, and a report has been prepared by Chairman W. W. Wattles. The committee, at a meeting held March 13, adopted a report presented by Director E. M. Bigelow, of the department of public works, which provides for

absolutely open competition in future bids for street paving, restricting neither the number of bidders nor the brands of asphalts, but requiring them to conform in quality to a certain defined standard—"equal in quality to that mined from the Sicilian mines at Ragusa and Varwohle, from the Swiss mines at Val de Travers, from the French mines at Seyssel and Mons, and from the Pitch Lake on the Island of Trinidad." For carrying out this purpose he will adopt the specifications for asphalt paving in New York City.

For further protection as to the character of the work a stipulation will be required both in the contract and the bond accompanying it, guaranteeing to keep in good condition and repair the pavement for the period of five years, though if desired by the council this period will be extended to ten years. After some discussion a motion was finally made by Mr. Leslie that the time limit for repairing be placed at ten years, and for new paving at five years. This motion was adopted.

PROPOSED SPECIFCATIONS FOR PAVING IN SAN FRANCISCO.

The recommendations regarding pavements which Ernest McCullough, C. E., made to the Merchants' association, at San Francisco, Cal., have been put into the shape of an ordinance to amend order 2,146 by adding thereto "specifications for paving with asphalt, wooden blocks and vitrified brick, to amend the specifications for paving with basalt blocks and to provide for the paving of accepted streets with any other paving material which the contractor will guarantee to maintain in good order for five years from the date of the completion of the work."

Some of the important provisions proposed are in reference to asphalt paving and are as follows:

"Before the time of opening the bids for asphalt paving the bidder must deposit with the superintendent of streets the following samples, which he will guarantee to be equal to the materials he will use: First, a sample of the carbonate of lime or mineral dust; second, a sample of sand; third, a sample of the asphaltic cement; fourth, a sample of the liquid asphalt; fifth, a sample not less than six inches square of the required thickness of the finished wearing surface. This sample shall have a corner broken off and a certificate of a competent chemist shall be filed with it which shall state that the chemist broke the piece off the corner and analyzed it, and he shall state in said certificate the quantities of the materials therein and their quality as shown by his analysis. The certificate of the chemist shall be filed with the samples at the expense of the contractor furnishing the same. During the progress of the work the contractor shall permit the superintendent of streets to take samples of the materials and test them to satisfy himself that the materials used comply in all essentials with the samples submitted with the bids."

Provisions concerning the use of wooden blocks were defined as fololws: "Kiln-dried blocks of white or yellow pine treated with not less than ten pounds of creosote to the cubic foot may be used. The dimensions may be 4x4 or 6x6 inches square, and 4 inches deep, measured along the grain. Or the blocks may be 3 inches wide, 7 to 10 inches long and 6 inches deep. But only one size or kind of block may be used on any one piece of work. They shall be laid in lines across the street with as close joints as it is possible to make, and when the pavement is completed the joints shall be filled with asphalt and the pavement covered with asphalt and gravel, as specified for the laying of redwood blocks.

"Kiln-dried eucalyptus may be used in blocks 6 inches deep (measured along the grain), 3 inches wide and from 7 to 10 inches long. Iron bark eucalyptus shall not be used. If red gum (E. rostrata) or blue gum (E. globulus) are used they shall be treated with creosote as prescribed for pine blocks. Tallow wood (E. microcorys) or black butt (E. pilularus) will not require any treatment."

A PUBLIC-SPIRITED MERCHANT'S OFFER.

A. M. Fuller, a merchant of Meadville, Crawford county, Pennsylvania, has offered to give $200 to every township in the county which within two years will begin the construction of crushed stone roadways eight feet wide, costing from $800 to $1,000 per mile. That the existing roads of Pennsylvania depress the price of real estate, injure business of all kinds, make rural life an imprisonment for those months of the year during which society is most needed and cause the young people to detest the farm without their knowing the real cause of the dislike, is doubtless appreciated by Mr. Fuller if it does not seem to be appreciated by the legislature.

GRAVEL ROAD BONDS IN INDIANA.

The Supreme Court of Indiana rendered a decision Feb. 23 in the case of the board of commissioners of Monroe county against John P. Harrell. Suit was brought by Mr. Harrell to enjoin the commissioners from letting a contract to build free gravel roads in Clear Creek township, on the plea that issuing the necessary bonds to pay for the roads would create a township indebtedness in excess of the constitutional limit. The injunction was granted by the Circuit Court. The Supreme Court reversed this judgment, however, on the ground that the bonds to be issued in payment for a free gravel road are not payable by the town-

ship out of its general fund, nor out of any township taxes, but are payable out of a special tax, levied by direct authority of the Legislature upon the property in a taxing district which may be all or a part of one or several townships; this tax is imposed, not according to the value of the property, but according to the benefit it will receive from the improvement, and the money thus raised can be applied to no other purpose, except to pay the bonds and interest, and the money realized from the sale of the bonds can only be used to build roads.

NUMBERING OF BRIDGES.

The county seat of Jackson county, Missouri, has directed the county surveyor to number all the county bridges, of which there are 1,200. The numbers will run consecutively from 1 to 1,200, and will prove of great aid in making repairs on both the roads and bridges of the county.

ILLEGAL ASSESSMENT OF ABUTTING PROPERTY.

The city of Portland, Ore., was defeated March 16 by a decision of the Supreme Court in an action brought by one of a number of property-owners to prevent the city from assessing the cost of their improvements against abutting property-owners when the improvement had not been petitioned for. The city claimed that the street was in an unsafe condition and improved it by macadamizing it and laying walks and taxing property abutting therefor. The case was referred to Judge Thayer, who reported that the street was not unsafe and dangerous and therefore could not be improved at the expense of property-owners. The court confirmed his report and the Supreme Court sustained the lower court's decree.

THE PROPERTY-OWNERS' RIGHT OF PETITION.

In accordance with an opinion by City Counselor MacDougal, the board of public works at Kansas City, Mo., has rejected the plans and specifications submitted by City Engineer Wise providing that petitions for asphalt and brick pavements be disregarded and making the resolutions for such improvements conform to materials on file in the city engineer's office.

Mr. MacDougal submitted his opinion in the shape of a representative resolution, embracing a form of specifications for asphalt paving which insures the fullest competition and yet guarantees to the property-owners the charter right to select whatever brand of material may be desired and to have it laid in whatever manner the owners wish. The board of public works adopted the specifications March 19 and they will become the standard for all succeeding paving resolutions, ordinances and contracts. The specifications as prepared by City Counselor MacDougal provide for any asphalt or brick deemed of standard quality by the city engineer. Asphalt shall be laid with wearing surface one and one-half inches thick, on a bituminous concrete binder course one and one-half inches thick, upon a foundation of hydraulic cement concrete six inches thick. The board will order paving done, specifying standard asphalt or brick, and any company handling standard asphalt or brick may bid on the contract irrespective of petitions from property-owners. This settlement of the difficulty is looked upon as amounting to practically what City Engineer Wise had in mind in the beginning.

MOVABLE BRIDGES OVER THE CHICAGO DRAINAGE CANAL.

The drainage trustees of Chicago, Ill., have, according to local press reports, decided to build swing bridges across the sanitary channel. The bridges will be spiked down and the machinery for swinging them will not be installed until such time as the channel is used for navigable purposes. A vigorous contention for complying with this one provision of the law has been made for some time by the valley people. The trustees' objection to erecting swing bridges has been all along their additional cost over that of fixed bridges.

A NEW CEMENT IN ENGLAND.

A new cement, called petrifite, has been introduced in the market in England. The composition of the material is not known, but it resembles Portland cement in its general action. While it is employed chiefly in the manufacture of piping, slabs, tiles, conduits, etc., in conjunction with cement, yet, if powdered, it will bind together in a solid stonelike mass a number of substances, such as wood, paper, pulp, earth material, sea sand and powdered slate. Electrical engineers strongly recommend it for the foundations of dynamos.

LOCAL ROAD IMPROVEMENT ASSOCIATIONS.

Engineer McClintock, of the Massachusetts State Road Commission is in favor of forming in the smaller towns, road associations that shall study local conditions and the science of road building, and improve their own roads in a business-like manner.

CONTEST BETWEEN ASPHALT COMPANIES AT NIAGARA FALLS.

Evidence has been heard from time to time since Feb. 26 in the injunction proceedings over the award of the contract to the Barber Asphalt Paving company for paving Falls street and Erie and Buffalo avenues in Niagara Falls, N. Y., with asphalt. The bid of the Barber company for Trinidad Pitch lake asphalt was $2.44, and the bid of the Utica Paving company on Alcatraz asphalt was $2.15. The Standard Paving company bid $2.41. Loran L. Lewis has heard the testimony as referee. Many witnesses have been examined, including officers of the interested companies, city officials and others. When President Greene of the Barber company was on the stand, March 20, he was asked by the examining attorney to show the books of his company. This he declined to do and was sustained by the referee.

HIGHWAY IMPROVEMENT DISCUSSED BY EXPERTS.

The Connecticut Valley Highway Association, at its first annual banquet at Springfield, Mass., was attended by a representative gathering of experts in highway construction and maintenance, state, county, city and town officials and business men. Addresses were delivered by William E. McClintock, Boston; George H. Smith, Mayor of Holyoke, Mass.; F. A. Dunham, City Engineer, Plainfield, N. J.; John L. Mather, Northampton; Henry Hanley, Boston. Alderman Chillingworth, New Haven; C. W. Ross, Newton, Mass. W. E. McClintock, in his address, said: "Since the old stage coach days practically nothing has been done on the highways of this country. The people of this state have been taxed more by bad roads than by any tariff or other taxes imposed. In this state there is one horse to every 12½ people, while in England and Scotland one horse does the work for from twenty to twenty-five people. If we could save this difference it would mean to this state a saving of over $4,000,000 a year."

Henry Hanley said that the macadam road is the improved form of the old stone road. In building these roads there are one or two points ever to be considered. In the first place water is the great enemy of the road, while it is also its best friend. The foundation must be free from water and the surface must be such that it will shed the water. Passing from the country into the city of large center of population there comes a point where the macadam road ceases to be a comparative success and becomes a failure on account of the increase in the amount and weight of travel.

C. W. Ross briefly outlined some of the experiences of the town of Newton with macadam and gravel roads. He said that "one grave trouble in the construction of gravel roads is that the road builder too frequently takes it for granted that any gravel is all right. Large or coarse gravel should be used for the base, smaller above this and the finer screenings for the top dressing or binder, each layer being rolled with a steam roller or even with a horse roller."

Mr. Dunham, who had charge of the construction of the roads in Essex and Union counties, New Jersey, spoke on the problems that confront the engineer and superintendent in charge of county highway improvements. He said:

Road builders seem sometimes to forget that the main object of a telford or ballast foundation is to give a body to the pavement and furnish an adequate means of drainage, and not to supply a wearing surface, and consequently any stone capable of supporting the weight of the traffic is suitable for the foundation of the pavement.

In this connection I would say that during the past year I have built and have now in progress in Bergen and Somerset counties in New Jersey, ten-inch pavements, composed of a six-inch layer of selected hammer-broken field stone (mostly sandstone), coverd with four inches of crushed trap rock, which I consider equal for general use to pavements of similar thickness built wholly of trap rock. These pavements are being constructed for about two-thirds of the cost of the kind last mentioned.

The agitation for improved highways has brought gravel roads into prominence in localities where stone is not easily obtainable. These roads can be cheaply constructed and maintained. They are not as durable as first-class stone roads, but this is largely offset by the comparatively small cost of their construction and maintenance.

I am not advancing any new theory when I say that in any engineering work, material of medium or even poor quality, can, by careful manipulation, be made to produce better results than first-class material carelessly put together. Nowhere is this principle better illustrated than in the misuse of excellent material, which is being made on some of our roads, where tons upon tons of first-class stone are being buried in sand and loam and called good roads.

With all respects to our friends, the wheelmen, who constitute one of the prime factors in the work for improved highways, we must not build cycle paths, but roads. A pavement that can easily sustain a traffic of rubber tired vehicles, and at the same time continue to present a perfect surface, may not be able to do as much for a traffic of horses and wagons, and it is for this latter kind of traffic (at least until the time when horseless carriages come into more univarsal use) that we must provide.

Another feature of road-building which is often neglected in the anxiety for a fault-

less surface, is the drainage of the road-bed, more particularly the sub-drainage. Nothing is more fatal to the durability of a pavement than poor drainage. Before any stone is applied a careful inspection of the road-bed should be made in order to discover any springs or spots which are unfit to receive the foundation, and provision should be made for the drainage of such places as require it. Wherever the bottoms of the gutters of the road are lower than the bottom of the pavement a simple and satisfactory method of draining the pavement is to lay blind drains from the pavement to the gutters. These may be built by excavating a trench, say two or three feet in width, from the edge of the pavement to the gutter, taking care to have the bottom of the trench slightly lower than the bottom of the pavement, and refilling the same with a layer of rock of about four-inch dimensions, covered with crushed stone. These drains are easy and cheap to construct, and answer the purpose admirably. It is also more important to provide for the escape of the water from the foundation of the pavement wherever two descending grades intersect, otherwise the water will collect at these points and saturate the pavement, with the action of the frost, must result disastrously.

A macadam road cannot be left to itself after it is completed, as an asphalt, brick or stone block pavement can, but needs constant supervision and repairs when necessary to make it mose durable. In nothing more than in road maintenance is the truth of the old proverb that "a stitch in time saves nine" apparent. Every district should own a roller weighing at least four tons, and a supply of crushed stone should be stored at convenient points along the line of the improved roads so that whenever a small soft spot or rut appears in the surface of the road it can be promptly repaired.

There are two general methods of maintaining highways. One is for the municipality to buy the material and employ the labor directly. The other is to contract the work at a certain rate per mile of road in a county or township, and to appoint an engineer or superintendent, with as many assistants as may be necessary, to see that the work is properly done. There are no doubt case where the former method is more economical and satisfactory, especially where there is only a small amount of road to be maintained; but I am of the opinion that in most instances the latter method will be found more satisfactory in all respects. The first method, under our present system of government, simply supplies so many more public offices to be filled, and the unhappy individual who has charge of road maintenance is beset on every hand to appoint this or that man regardless of his fitness for the position. This system is apt to build up a force of men to work upon the highways whose chief and only qualification is a "pull," and as is well known, there are many reasons why public affairs of this nature are not always economically administered.

The contract method is clean, businesslike and economical. It enables the official in charge to confine himself to the duties of superintendence, rather than to looking after details, and thus enables one person to have a comprehensive oversight of a much larger area, which is always an advantage in securing systematic work.

With the growth of the good road movement has come a fuller realization of the importance of entrusting the design, construction and maintenance of improved highways to men specially trained in this department. This is recognized in nearly all of the road laws that have been passed in the different states during the last ten years. I think that men should be appointed to the office of engineer or superintendent of road construction, rather than elected. A governing body is more apt to consider the qualifications of the candidate for the position and hence to choose a more able man, than will the people at large at an election, when local excitement or prejudice may result in the choice of a man totally unfit for the office.

Many municipalities find it advantageous to employ an experienced consulting engineer to take charge of the design of the road system, and to draw up proper specifications for the construction, and then to leave the superintendence of the work to some competent local man.

NEW PUBLICATIONS.

"Municipal Affairs," Vol 1, No. 1. Edited by Robert C. Brooks. Published by Committee on Municipal Administration, Reform Club, 52 William street, New York. Price $1 per annum.

The Reform Club of New York has undertaken work of vast importance by creating a Committee on Municipal Administration for the purpose of developing sound public sentiment on beneficent administration of city affairs. The work must necessarily be largely educational, and the committee has wisely started in a scientific way by gathering together the literature pertaining to municipal affairs, thus making available the best knowledge on every phase of city problems. This work, in its embryotic stage, is represented by the first issue of a quarterly, comprising 224 pages, devoted to a bibliography of municipal administration and city conditions, which, while incomplete, is a very good beginning, and will be valuable to all who are interested in this range of subjects. The magnitude of it is such that one is surprised to find any omissions. It covers 3,400 articles, arranged alphabetically, with cross references. The work will be supplemented in later numbers of the publication, which should be in the possession of all who are interested in or have duties connected with the development of municipal affairs. Mr. Robert C. Brooks is the editor of the quarterly and also the secretary of the Committee on Municipal Administration.

Report on Public Baths and Public Comfort Stations. Published by the Mayor's Committee on Public Baths and Public Comfort Stations, New York City.

In American cities, with few exceptions, there has been sad neglect of proper facili-

ties for baths, accessible to the masses who need this help to better health and better citizenship, and there is well near inhuman disregard of the need of comfort stations in the more densely crowded business districts of the larger cities. Nearly two years ago Mayor Strong of New York City appointed a committee composed of William Gaston Hamilton, C. E., Moreau Morris, M. D., and William Howe Tolman, Ph. D., to study the subjects and submit a report. Their work has been done thoroughly and their report leaves nothing to be desired in the way of information bearing on the subject. It is quite as valuable to the country in general as New York, and deserves the careful consideration of all who are interested in bringing about better conditions in cities.

Second Annual Report of Board of Public Works of Kansas City, Mo., for the fiscal year 1895.

It is unfortunate that the publication of this report has been delayed nearly a year. It contains quite full statistical information as to the work done prior to April, 1896.

Report of the Board of Park Commissioners, Wilmington, Del., for the year 1896.

Wilmington, with a population of 70,000, has 241.45 acres of parks, an average of one acre to 276 inhabitants. Illustrations in the report indicate that the system has beautiful features, but parks, to be put in proper condition, often require some attention and some expense. It seems that this is lacking in Wilmington, as the superintendent calls attention to much improvement work that cannot be done because money is not provided for it. Next to the sin of not providing parks at all, the most reprehensible fault of city administration is to fail to have them properly improved and cared for. Various suggestions for minor improvements are offered by the superintendent, Theo. A. Leisen.

"Good Pavements Essential to a Successful City." By J. W. Howard, B. L. C. E. New York. Reprint from Municipal Engineering Magazine.

Report of the Water Commissioners of the Town of Walpole, Mass., for the year ending Dec. 31, 1896.

Sixth Report of the Board of Water Commissioners of the City of Windsor, Ont., for the year 1896.

Report of the Committee on Sewerage and Sewage Disposal for the Village of Stockbridge, Mass.

This embraces the report of Freeman C. Coffin, C. E., who recommends disposal of the sewage of Stockbridge by intermittent filtration on land suitable for filter beds near the Housatonic river and the construction of the separate system of sewers. Mr. Coffin estimates the cost of the system at $29,767.

"Advantages of Good Pavements and Attractve Streets." By J. W. Howard, B. L. C. E. Reprint from the Engineehing Magazine.

PERSONAL.

R. M. Clement has been elected city engineer at Oakland, Cal.

E. O. Burlingame has been elected city engineer at Guthrie, Okla.

Frank A. Leiter, assistant street commissioner, Toledo, O., died March 6.

George A. Beal has been elected water commissioner at Abington, Mass.

George W. Wilde has been elected water commissioner at Holbrook, Mass.

Frank H. Locke has been elected water commissioner at Lexington, Mass.

George Cantello has been elected water commissioner at Southboro, Mass.

Thomas N. Crowley has been elected water commissioner at Walpole, Mass.

E. Lewis Moore has been elected sewer commissioner at Framingham, Mass.

Daniel W. Kimball has been elected water commissioner at Winchester, Mass.

E. H. Fortin has been appointed acting superintendent of streets at St. Albans, Vt.

Charles E. Kirk succeeds Leon H. Evans as superintendent of sewers at Pawtucket, R. I.

Charles Oliver has been appointed superintendent of water works at Wheeling, W. Va.

William M. Akin, Jr., has been elected at Evansville, Ind., to succeed Mayor Hawkins.

Paul M. Van Name has been appointed street commissioner at Port Richmond (S. I.), N. Y.

Henry D. Yerxa has resigned his position as a member of the park commission at Cambridge, Mass.

Theodore G. Bennett, president of the Bennett Sewer Pipe company, Grand Rapids, Mich., died March 4, aged 55.

Frank L. Weaver has been elected president of the water board at Lowell, Mass., to succeed George E. Putnam.

Amos H. Perkins, vice-president of the Western Paving and Supply company, Chicago, Ill., died in that city Feb. 24.

James H. Shanahan, ex-superintendent of public works of the state of New York, died at Albany, N. Y., march 12, aged 69.

Charles Martin of Louisville, Ky., has been appointed inspector of sewers, to succeed Isnpector McCleary, who resigned.

A. S. Cooper of Santa Barbara, Cal., has been appointed by Governor Budd to succeed J. J. Crawford as state mineralogist.

Franklin Brinker has been appointed chief engineer of the water works at Cumberland, Md., to succeed Chief Engineer Walker.

Howard S. Whiting has been appointed superintendent of parks at Cambridge, Mass., to succeed George R. Cook, who resigned recently.

Abram Joralemon, commissioner of the board of works, Newark, N. J., died unexpectedly, March 8, of pneumonia, after less than a week's illness.

William M. Black, M. Am. Soc. C. E., U. S. Engineer Corps, has been appointed engineer commissioner of the District of Columbia, at Washington, D. C.

Theodore C. Heroson has been appointed by Mayor Seymour, at Newark, N. J., to fill the unexpired term in the board of public works, of Abram Joralemon, who died March 8.

T. J. Davis, alderman, and Harry Willink, commissioner of public works of Savannah, Ga., visited Jacksonville, Fla., recently to inspect the brick pavements in that city.

Sherman S. Jewett, a member of the board of park commissioners at Buffalo, N. Y., died Feb. 28, aged seventy-nine. Mr. Jewett was the originator of the park system in Buffalo.

Mr. F. C. Marsh, formerly manager of the road machinery department of the Aultman company, Canton, O., has taken the management of the rock crusher department for the Gates Iron Works, Chicago, Ill.

W. E. Sidney, for several years manager of the Davenport Paving Brick & Tile company, Buffalo, Ia., has resigned his position with that company and accepted that of manager of the Jamestown Shale Paving Brick company, at Jamestown, N. Y.

W. W. Follet, M. Am. Soc. C. E., Denver, Col., has been appointed consulting engineer on the United States International Boundary Commission, which was created in 1889 to determine the boundary line between the United States and Mexico, along the Rio Grande river.

Col. F. V. Greene, president of the Barber Asphalt Paving company, New York City, was recently presented with a silver centerpiece by his superintendents in commemoration of the eleventh anniversary of his connection with the company. An unique feature of the gift lies in a portion of the decorations, which vonsist of six vignettes descriptive of incidents of Col. Greene's career.

LETTERS FOR THE PUBLIC.

DESIRABLE DEGREE OF FINENESS FOR CEMENT.

To the Editor of Municipal Engineering:

I wish to know the most desirable degree of fineness for Portland and common cement. In your March number Mr. Lewis says (page 145): "There is no occasion, however, for going to extremes in this matter and making the fineness too high; 87.5 per cent. through the No. 100 sieve and 97.5 per cent. through the No. 50 sieve are quite high enough for ordinary work." But the published test for fineness of the Vulcanite Portland Cement company would indicate that a much higher degree of fineness is desirable, namely, 96.3 per cent. to pass a No. 100 sieve and 89.1 per cent. a 200 sieve. I take it for granted that a 200 sieve means 200 holes to the linear inch, and that the coarsest particles passing the 200 sieve are one-four-hundredths part of an inch. Of course this means that 89.1 per cent. is floating dust. This would seem to indicate that very fine pulverizing is desirable. Can you furnish any information on the subject?

S. R. KROM.

Jersey City, N. J., March 3.

The question is fully answered in Municipal Engineering for January, 1896, pages 44-46. Within practical limits "the finer the better." A balance is struck between increased value of finer grinding and increased expense in manufacture. Limits given by Mr. Lewis are "quite high enough for ordinary work," and high enough to specify at present, but it is an economic question, not one of proper work. Finer cement will stand more sand. "No. 200" sieve usually has holes .0025 to .0035 inch square.

INFORMATION FROM CITY OFFICIALS REGARDING STREET PAVING.

To the Editor of Municipal Engineering:

When paving was first agitated in our

city, being interested as a property-holder, I sought all the information I could get. I sent letters of inquiry to the city engineers of those cities which have had years of experience in paving, knowing with their experience I would be better able to select a paving material which had proved its merits. This information which I have acquired I thought would be beneficial to the many readers of your valuable magazine, who may be placed in a similar position. I herewith inclose a copy of the answers to the following questions I asked:

1. About how many square yards of street paving have you in your city and what kinds?
2. Which gives the best satisfaction?
3. Which, in your estimation, is the cheapest, when considered for a term of years?
4. Which do you recommend?

I trust that you may deem this worthy of space in your magazine.

J. J. McMAKEN.

Hamilton, O., March 17.

The answers received by Mr. McMaken are given below, the numbers corresponding with the questions above:

Cleveland, O., M. G. Rawson, Chief Engineer—(1) Medina (N. Y.) sandstone, 2,123,059 square yards; cinder macadam, 15,488 square yards; Nicholson wood, 33,450 square yards; brick, 574,409 square yards; block asphalt, none; sheet asphalt, 96,390 square yards; miscellaneous, 14,202 square yards. (2) No one kind. We use for medium traffic, asphalt; light traffic, brick, and heavy traffic, stone. (3) Depends entirely on quality of work and materials; with us Medina stone has been longest used. (4) Would not recommend without knowing conditions.

Muncie, Ind., City Engineer—(1) Brick, 2,000 square yards; sheet asphalt, 56,000 square yards. (2) Asphalt. (3) Depends upon the kind of traffic. (4) Upon such streets as we have asphalt.

Detroit, Mich., H. P. Sudden, City Engineer—(1) Brick, 336,497 square yards; block asphalt, none; sheet asphalt, 432,749 square yards; all other kinds, 3,140,000 square yards. (2, 3, 4) It is difficult to say which kind of pavement gives the best satisfaction. This is determined largely by local conditions. Asphalt, brick and cedar block on a concrete base give good satisfaction in this city.

Peoria, Ill., A. D. Thompson, City Engineer—(1) Brick, 473,194 square yards; block asphalt, none; sheet asphalt, 146,470 square yards; cedar block, 9,176 square yards; stone block, 29,622 square yards. (2) Asphalt and brick. (3, 4) Depends on the location of the street and the kind of traffic.

Columbus, O., City Engineer—(1) Brick and block, 1,439,060, square yards; block asphalt, none; sheet asphalt, 308,020 square yards. (2) Repressed block. (3) The best vitrified repressed brick. (4) Same.

Marion, O., A. W. Scott, City Engineer—(1) Brick, 120,000 square yards; sheet asphalt, 27,000 square yards. (2, 3, 4) Good shale block, on good foundation, and Murphy grout filler. Our streets have all been built in two and a half years and are mainly in good repair. The asphalt streets are the favorite principally so far on account of the smooth and easy riding surface. As to its durability I could not suggest, as it is a stranger entirely new to us.

Cincinnati, O., H. J. Stanley, Chief Engineer—(1) Brick, 450,000 square yards; sheet asphalt, 400,000 square yards; block asphalt, only a specimen patch about 300 square yards. Being somewhat acquainted with your town I answer questions 2, 3 and 4 by stating that in my judgment, considering the points of desirability and economy, sheet asphalt is the pavement I recommend. The indications are strong that this is the coming pavement for general use in cities where it can be laid.

Philadelphia, Pa., Thomas L. Hicks, Chief Bureau of Highways—(1) Cobble stone, 97.38 miles; rubble stone, 76 miles; granite block, 343 miles; vitrified brick, 85.04 miles; sheet asphalt, 171.62 miles; block asphalt, 19.17 miles; macadam,161.52 miles; granolithic, 11.83 miles; slag block, 2.22 miles. In reply to your question as to which kind of paving gives the best kind of satisfaction would say that on streets where their is heavy traffic granite blocks laid upon cement concrete foundation give the best satisfaction and are the cheapest when considered for a term of years. Sheet asphalt makes an elegant pavement for driving purposes, and, after granite blocks, is considered the best pavement under all circumstances for heavy or moderate traffic. Vitrified bricks make a good pavement for residential streets or streets not subjected to heavy travel of any description, but they have not been in extensive use for sufficient length of time to warrant us giving an estimate as to their durability.

Washington, D. C., Charles F. Powell, Corps of Engineers, U. S. A., Commissioners District Columbia—(1) Cobble stone, 302,338 square yards; granite block, 599,592 square yards; brick, 6,885 square yards; block asphalt, 318,559 square yards; sheet asphalt, 2,405,932 square yards. (2) Asphalt. (3) Asphalt; asphalt block for light travel. (4) Asphalt; asphalt block for light travel.

Denver, Col., P. O'Brien, City Engineer—(1) Sheet asphalt, 240,000 square yards; block asphalt none; brick, 100 square yards. (2) Asphalt. (3) Asphalt. (4) Asphalt.

Toledo, O., William G. Clark, City Engineer—(1) Medina stone, 431,000 square yards; cedar blocks, 326,000 square yards; brick, 378,000 square yards; sheet asphalt, 335,000 square yards. (2, 3, 4) Would depend upon the character of the property, whether residence or business, amount of traffic, grades on streets and several other things. No general answers could be given that would be of much value.

Buffalo, N. Y., Edward B. Guthrie, Chief Engineer—(1) Sheet asphalt, 4,000,000 square yards; brick, 60,000 square yards. (2, 3, 4) Have not had brick long enough to answer.

Rochester, N. Y., E. A. Fisher, City Engineer—(1) Sheet asphalt, 27.38 miles; block asphalt, 0.708 miles; brick, 4.147 miles; Medina block stone, 2.05 miles; Medina stone, 25.92 miles; cobble stone, 1.58 miles; cedar block, 0.73 miles; macadam, 21.84 miles; trap rock macadam, 3.23 miles; gravel, 23.06 miles. (2) Medina block stone for very heavy traffic, and next sheet asphalt. (3) Depends upon amount of traffic. (4) Depends upon amount of traffic and local conditions.

Dayton, O., F. M. Turner, City Engineer—(1) Brick, 282,618 square yards; block asphalt, 13,602 square yards; sheet asphalt, 355,504 square yards. (2) Sheet asphalt. (3) Asphalt. (4) Asphalt or asphalt block. Asphalt has the preference in this city, brick being too noisy and slippery. The asphalt block makes an elegant pavement if properly laid; it is smooth and durable, but it costs considerable more than the sheet asphalt.

Brooklyn, N. Y., City Engineer—(1) Sheet asphalt, 675,000 square yards; block asphalt, 800 square yards; brick, 15,000 square yards.

Niagara Falls, N. Y., W. W. Reed, City Engineer—(1) Sheet asphalt, 42,000 square yards; brick, 43,000 square yards. (2) Asphalt. (3) First quality of sheet asphalt. (4) First quality of sheet asphalt.

Minneapolis, Minn., F. W. Cappelen, City Engineer—(1) Sheet asphalt, 178,674 square yards; brick, 15,355 square yards. (2, 3, 4) I hardly feel like recommending brick for a street where the tonage of travel exceeds a hundred tons per foot of width of street. Asphalt will carry several times this amount.

THE DECISION IN THE DENVER PAVING CONTRACT CASE.

To the Editor of Municipal Engineering:

Judging from the comments in the Denver (Col.) daily papers, there seems to be a good deal of uncertainty as to the significance of the opinion of the United States circuit court of appeals in the case of Hugh Murphy vs. Board of Public Works of Denver.

It has been stated that the court upheld the board in its ruling that Alcatraz asphalt, the material which Murphy proposed to use, was inferior to Trinidad asphalt. The facts, however, do not seem to bear out this claim.

It appears that the Board advertised for bids on sheet asphalt pavement for certain streets. Hugh Murphy was the lowest bidder by about $12,000, the Colorado Paving company, using Trinidad asphalt, being next above him. The Board rejected Murphy's bid on the ground that he proposed to use Alcatraz asphalt, which, they claimed, was an inferior material. Murphy took the matter into the courts and tried to compel the awarding of the contract to him as the lowest bidder. The court, however, decided (with manifest justice) that the charter provision, for awarding the contract to the lowest bidder, was enacted for the protection of the taxpayer, not for the benefit of the contractor. Murphy, therefore, had no standing before the court and, consequently, could not prevent the award of the contract to the Colorado Pacing company. The court stated in its opinion that the evidence submitted showed Alcatraz to be equal in quality to Trinidad, thus directly contradicting the claim that the Board of Public Works was sustained in its ruling as to the quality of the material. ———,

New York, March 16.

MACHINERY AND TRADE.

STEAM ROLLER COMBINATION.

It is reported that an agreement has been entered into by four of the steam road roller manufacturing companies regarding sales, and that prices will hereafter be fixed for each sale by two representatives, on the basis of one-half of the sales being accorded to one of the companies and the other half to be divided between the other three companies. In each case where there is competitive bidding, therefore, the lowest bid will be submitted on the roller of the company entitled under the agreement to the sale. An attempt is also being made to unite the road michinery companies in a similar combination, except as to certain territory, and this arrangement is already well advanced. It is claimed that the purposes of these combinations are to maintain profitable prices, to divide the business so that each company will get a fair share and to reduce expenses. The steam road roller people reported to be interested in the new arrangement are the Kelly, Harrrisburg, Pitts and Columbiana companies.

LAGERDORFER PORTLAND CEMENT.

A handsome brochure on Lagerdorfer Portland cement has been issued by the Kelley Island Lime and Transport company of Cleveland. It contains about seventy pages, and in addition to much information as to the manufacture of Lagerdorfer Portland cement and its merits, illustrates the text with many fine half-tone engravings showing views of parks, streets, buildings, etc., in connection with which this brand of cement has been used. A few of these illustrations are reproduced elsewhere in this magazine. Suggestions are given in the book regarding methods of using cement, and specifications are given for sidewalks, cellar floors, etc., as well as the proportions of Lagerdorfer cement to be used to carry a given load per square foot. Many testimonials to the merits of Lagerdorfer cement from engineers, public officials, con-

tractors and others, are also set forth. Copies of the book can be obtained from the Kelley Island Lime and Transport company, Cleveland, O.

TRADE NOTES.

The purchase of a stone crusher is contemplated at Baraboo, Wis.

The purchase of a stone crusher is contemplated at Curtisville, Mass.

The question of purchasing a road scraper has been favorably voted on at Rockland, Mass.

The city officials at Everett, Mass., have voted to purchase a steam roller at a cost of $3,000.

The citizens of St. Albans, Vt., are considering the question of purchasing a stone crusher.

An appropriation of $8,000 will be made for the purchase of a new stone crusher at Melrose, Mass.

The purchase of a road machine is contemplated at Middlebury, Vt. J. M. Slade and G. H. Eldridge, selectmen.

The prices for a rock crusher, conveying plant, etc., are desired at Warrenton, N. H., C. H. Scott, C. E., road supervisor.

The highway committee, Northampton, Mass., is considering the question of purchasing a portable stone crusher this year.

The Union Akron Cement company, Buffalo, N. Y., has contracts for furnishing the Akron star brand cement for a number of new buildings.

The purchase of a stone crusher and a steam road roller, at a cost of about $6,000, has been favorably voted on, at Eden, Mo. B. S. Higgins, selectman.

The purchase of a stone crusher has been recommended by Chas. E. Buzzell, street commissioner, Laconia, N. H. Address Councilman Pulsifer.

The selectmen at Wolfboro, N. H., contemplate the purchase of a stone crusher. John H. Horne, John A. Chamberlain, F. E. Hersey, Commissioners.

The New England Public Works company, New Haven, Conn., was dissolved Feb. 26 by order of court and the assets divided among the stockholders. The stockholders asked that the company be dissolved.

A building has been erected by Erastus G. Smith, professor of chemistry at Beloit College, Beloit, Wis., independent of the college laboratory, to be devoted exclusively to chemical and bacteriological examinations of water.

The Purington Paving Brick company, Galesburg, Ill., secured contracts recently for paving brick for Ogden avenue, 2,400,000, and Rogers Park boulevard, 2,000,000, at Chicago; also for two paving contracts at Evanston, Ill.

Henry R. Worthington secured a contract recently from the Newport News Shipbuilding & Dry Dock company, amounting to $100,000, for pumps for the United States battleships, Kearsage, Kentucky and Illinois. Other recent contracts which this company has filled for vessels are: hydraulic machinery for operating the turrets on the United States battleship Iowa; pump and pumping machinery for the United States battleship Alabama; pumps for the armored cruiser being built by Wm. Cramp & Sons' Ship & Engine Building company for the Japanese government, and pumps for the Japanese cruiser Yoshi-Ho.

According to press reports the citizens of Gainesville, Fla., have subscribed funds for the purchase of a street sweeper.

The purchase of a steam roller and a stone crusher has been recommended by Chairman Hall of the street committee, at Revere, Mass.

The recommendation to purchase a steam road roller has been voted down, at Seneca Falls, N. Y.

The Nelsonville Sewer Pipe Works, which burned in December, 1896, at Nelsonville, O., will be rebuilt.

The selectmen at Otis, Mass., have been authorized to purchase a road machine. J. E. Merritt, town clerk; C. R. Comwell, jr., selectman.

Bids, plans and specifications will be received until April 7, at Oroville, Cal., for a rock crusher having a capacity for crushing 12 to 15 tons of rock an hour.

An appropriation of $1,000 has been voted at Litchfield, Me., for the proposed purchase of a road machine. Henry Woodward and F. M. Adams interested.

The works of the Hamburg Vitrified Brick Manufacturing company, Hamburg, Pa., have been put in operation.

The joint purchase of a modern rock crusher, with elevator and revolving screens, is contemplated by the board of trustees and the board of supervisors, at Chico, Cal. E. T. Reynolds, board supervisors; Chairman Williams, board trustees.

The Santa Maria Asphalt company has sold to the Consolidated Asphalt company of Los Angeles, Cal., 300 acres of asphalt land in Santa Barbara and San Luis Obispo counties for $30,000.

The stockholders of the Clinton Paving and Building Brick company, Clinton, Ind., have elected directors as follows: Ex-Governor Matthews, B. H. Morgan, J. E. Newalls, H. C. Dies, W. L. Morey. Officers—President, W. L. Morey, treasurer, B. H. Morgan; secretary and sales agent, J. W. Robb; superintendent, D. C. Porter.

Sealed proposals will be received until April 5, at Niagara Falls, Ont., Canada, for furnishing a 10 or 12 ton steam road roller. John Robinson, clerk.

Sealed proposals will be received at Hornellsville, N. Y., until April 2, for furnishing a 12-ton steam road roller. F. W. Dalrymple, city engineer.

The California Asphalt company of Philadelphia, Pa., contemplates locating a refinery in Ventura, Cal., at a cost of $50,000, according to the Ventura press.

The question of purchasing a stone crusher is being considered at West Brownsville, Pa.

The purchase of a stone crusher is contemplated at Pittsfield, Me. O. S. Haskell and C. W. Weeks, interested.

An appropriation of $3,000 has been made at Billerica, Mass., for the purchase of a stone crusher. J. E. Rowell and E. B. Haskell, selectmen.

The purchase of a road machine is contemplated at Cambridge, Me., an appropriation having been made for that purpose. D. B. Whitney, H. F. Quimby, selectmen.

The Gem City Manufacturing company of Erie, Pa., has been closed up by the sheriff and its affairs are now in the hands of John

S. Rilling as receiver, who will collect bills due the company and settle its debts. The plant and business of the Gem City company were purchased at sheriff's sale by E. G. Skinner and will be operated under the name of Skinner Iron Works.

In the last report of the Indiana state geologist a great deal of space is given to the shale beds of Indiana, special mention being made of the superior quality of shale in Clay county used by the Chicago Sewer Pipe company of Brazil, Ind., in the manufacture of their sewer pipe. Recent tests of this pipe made by Prof. M. A. Howe of the Rose Polytechnic Institute of Terre Haute, Ind., confirm the opinion of Prof. Blatchley. Prof. Howe's test of three pieces of 15-inch pipe, broken by water pressure from inside and free of any end pressures, show mean tensile strength of 1,203 per square inch. Prof. Howe says that the average strength determined by him in 1890 from 117 hydrostatic tests of pipe from fifteen factories was 610 per square inch. The average of shale pipe his tests show to be 762 and of fire clay 638. His compression tests show a load per inch in pounds of 214 for shale and 131 for fire clay. His absorption tests show the per cent. of dry weight at the end of forty-eight hours to be from 1.12 to 1.33 for shale, and from 3.31 to 5.65 for fire clay. State Geologist Blatchley expresses the opinion that the advantages of this section in Indiana, both for clay and coal, are unsurpassed in the country.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Atlanta, Ga.—The bids submitted March 15 for asphalt, brick or block paving on Forsyth and Bartow streets will not be opened until April 1.

Saginaw, Mich.—The board of public works contemplates including American asphalts in the specifications for paving this year.

Saginaw, Mich.—The property-owners along Genesee avenue, between Janes and Hoyt, have filed a formal protest with the city clerk against the payment of the special assessment, which contains fourteen reasons for their not paying the assessments.

Chicago, Ill.—Warren avenue, from Homan to Fall street, will be completed this spring. The Assyrian Asphalt company, which has the contract for the work, laid all of it last fall but about 3,000 yards.

Jersey City, N. J.—The Hudson county board of freeholders has under consideration a resolution providing for the employment of all convicts sent to the penitentiary or county jail on public roads.

St. Louis, Mo.—The board of public improvements gave its approval, March 19, to specifications admitting natural rock asphalt as a paving material.

Oswego, N. Y.—The members of the department of public works, consisting of Commissioners McCaffrey, Clarke and Salladin, City Engineer Ormsby and Superintendent of Street O'Brien, visited Syracuse, N. Y., March 18, to inspect brick paving.

New York, N. Y.—(Special.)—Trinidad Pitch lake and Alcatraz asphalt are named in the New York specifications for 1897 as the standard materials. All other varieties of asphalt must be equal in quality to these two.

Toledo, O.—The Warren-Scharf Asphalt Paving company filed a petition in the United States court, March 4, asking for judgment against the city for $5,114.17 in payment for paving Bancroft street, from Ashland avenue to Monroe street, in 1891. The city held back 10 per cent. of the amount due, to be paid at the end of five years, and this has been due since July, 1896.

Cleveland, O.—Director Wright contemplates inviting competition in bids for brick paving by admitting four-inch brick. Heretofore bids have been received on five inch brick only, which were manufactured by a few only, while a number of firms manufacture four-inch brick.

Kansas City, Mo.—The board of public works and council accepted the paving on Washington street, March 5, which was paved by the Parker-Washington company. The company forfeited its contract March 20, however, through failure to file its bond with the city comptroller for paving Broadway, from Sixteenth to Twenty-first street, and bids will be readvertised for the work.

Des Moines, Ia.—An opinion was submitted to the board of public works, March 17, by the city solicitor, who says it would be illegal to ask for bids in one advertisement on several different specifications, and that the specifications must be made on something more exact, according to the statues, in order to obtain bids legally. The original resolutions, as adopted by the council, directed that bids should be obtained on different kinds of filler. The board decided to advertise for bids for curbing and sewering, but to wait for further instructions from the council before advertising for paving bids.

Elmira, N. Y.—John Keefe, superintendent of the city streets in the department of public works, in his report on the work of building macadam roads through the city, shows that during the fiscal year ending Feb. 1, 1897, 4,440 tons of crushed limestone were used at a total cost of $5 590, and 13,425 square yards of macadam were laid at a total cost of $1,755.36, or at an average cost of 50 1-3 cents a square yard, including excavation.

New Haven, Conn.—The court of common council adopted a draft for a new city charter March 22, and March 24 Mayor Farnsworth appointed a committee of five members of the common council to appear before the committee on cities and boroughs, in Hartford, March 25, and advocate the passage of the charter. The committee appointed consists of Alderman C. W. Pickett and E. P. Root and Councilmen James White, Thomas C. Wrinn and H. C. Fuller.

Nashville, Tenn.—A test is being made of Murray gravel for street building purposes on Bridge avenue, from the bridge to First street. The gravel, which comes from Murray, Ky., is of a decidedly yellow color and of greater consistency than ordinary river gravel. In laying it the surface of the street is excavated to the depth of 10 inches, and a foundation of broken stone is laid, a layer of gravel four inches deep is then laid and rolled with a roller, after which another layer of gravel is put down loosely.

Utica, N. Y.—A comparison of the prices paid per square yard for asphalt paving each year since 1888, averages as follows: 1888, $3.75; 1889, $4.05; 1890, $4:06; 1891, $3.83; 1983, $3.75; 1894, $3.12; 1895, $2.26; 1896, $2.31; 1897, $1.96.

CONTEMPLATED WORK.

Susquehanna, Pa.—Paving is proposed for Main street.

Mason City, Ia.—Paving is contemplated for Main street.

Marshalltown, Ia.—The citizens are interested in the street paving question.

Stevens Point, Wis.—The council has voted to pave about two miles of streets.

Memphis, Tenn.—Paving is proposed for Pearl street by the principal property-owners.

North Adams, Mass.—Jas. E. Hunter, commissioner public works, is planning for road improvements.

Akron, O.—A petition is being circulated for grading, paving and curbing Kirkwood street.

Ambler, Pa.—The construction of macadam paving on the principal streets is contemplated.

Lee, Mass.—The macadamizing of Main street and other road improvements is under consideration.

Roslyn (L. I.), N. Y.—The question of appropriating $81,000 for road improvements will be voted on.

Great Barrington, Mass.—Macadam paving is contemplated for Main and Railroad streets. Town Clerk Burget.

Cedar Rapids, Ia.—Paving is proposed for Sixteenth street, in Central Park, from First to E avenue.

Higginsville, Mo.—The construction of vitrified brick pavements at a cost of $10,000 is contemplated.

Mendota, Ill.—The press suggests that one block of paving be laid on Illinois avenue this summer.

Cambridge, Mass.—The sum of $40,000 has been appropriated by the council for paving Massachusetts avenue.

Oyster Bay (L. I.), N. Y.—This town will vote in April on the question of issuing $200,000 for road improvements.

Quincy, Mass.—An ordinance was introduced in council, March 15, appropriating $17,000 for paving Copeland street.

New Ulm, Minn.—Plans and specifications will be prepared for grading, graveling and guttering Third South street.

Columbus, O.—The property owners on Oak street, from Washington to Parsons avenue, are in favor of asphalt paving.

Marietta, O.—Ordinances have been passed for paving Second and Franklin streets with brick. Carl Becker, city clerk.

Norwood, O.—Asphalt or brick paving is proposed for Floral avenue. The question will be voted on during the spring.

Covington, Ind.—The city council decided, March 11, to pave the public square with vitrified brick. City Engineer Cook.

Pittsburg, Pa.—An ordinance has been adopted by the finance committee appropriating $150,000 for street improvements.

Pittsburg, Pa.—An ordinance has been adopted authorizing the grading, paving and curbing of Monongahela street. Geo. H. Welshons, mayor's clerk.

Boston, Mass.—An ordinance was introduced, Feb. 26, by Alderman Fitzgerald, providing for asphalt paving on Harrison avenue, between Kneeland and Oak streets; estimated cost, $15,500.

Warren, O.—The construction of 4,000 square yards of brick paving on concrete foundation and 8,000 square yards of limestone macadam is contemplated for this summer. Homer C. White, city engineer.

Washington, D. C.—The schedule of streets to be improved with the appropriation of $169,000 after July 1 has been completed. It includes paving and improvements for about fifty-two streets.

Auburn, N. Y.—The residents of South street have petitioned for either brick or asphalt paving for that street, the petition being referred to the special committee of common council.

Rockford, Ill.—(Special.)—F. G. Hogland, city clerk, says there is a proposition before the city council for paving several streets with brick. Asphalt has been considered some, but not seriously.

Rock Island, Ill.—The press suggests that the council complete the brick paving in this city by paving the connections between the paved streets, thereby giving continuous paving.

Oswego, N. Y.—(Special.)—F. J. O'Brien, superintendent of public works, says plans are being prepared for an asphalt pavement on E. First street, from Bridge to Utica, and W. Second street, from Cayuga to Oneida street.

Chatham, N. J.—A macadam road on Passaic avenue, from Main street to the Passaic river bridge at Cheapside, to connect with the new Northfield road to Orange, has been decided upon by the board of freeholders.

Quincy, Ill.—The city council adopted an ordinance, March 8, for paving with macadam and curbing S. Front street. The improvement of S. Twelfth street, from Jackson to Greenmount cemetery, is contemplated.

St. Paul, Minn.—Preliminary orders have been passed for paving the following: Broadway, from Third to Seventh; Broadway, from Seventh to Mississippi, and on Mississippi to Grove; Third street, from Sibley to Broadway.

Baltimore, Md.—An ordinance has been signed by Mayor Cooper for repaving Caroline street, from Gay to North avenue with asphalt. An appropriation of $33,500 has been made for repairing S. Tremont avenue and Scott street.

Saginaw, Mich.—Plans have been prepared for paving Washington avenue, between Johnson and Potter streets, with brick; estimated cost, $15,742. A. J. McIntyre, superindendent streets.

Boston, Mass.—Macadamizing, on a concrete base, is proposed for Gold, Silver, Athens and Bolton streets. Estimated cost, $22,100. Benj. W. Wells, superintendent of streets.

Quincy, Ill.—The property-owners contiguous to Locust Boulevard, at a meeting, March 20, subscribed $1,000 toward permanent improvement of the roadbed of that thoroughfare, from Twelfth to Twenty-fourth streets. George M. Janes, chairman committee.

Seattle, Wash.—C. H. Kiehl, engineer in charge of this city's half of the Seattle-Tacoma boulevard, expects to be ready by April 1 to receive bids on the work.

Joliet, Ill.—An ordinance has been adopted which provides for curbing and paving Washington street, from the C. & A. tracks to Spring bridge. Daniel Feeley, alderman.

Dubuque, Ia.—Brick paving is being considered by the council for Iowa street, from Third to Seventeenth, and all cross streets between Ninth and Fifteenth, from Bluff to Clay.

Ft. Wayne, Ind.—The citizens of Third street have presented a petition to the board of public works asking for vitrified brick paving the entire length of the thoroughfare.

Chicago, Ill.—Stewart R. Brown, who served as a member of the North Side road race course during 1896, is leading in the efforts to procure a cement track for Lincoln park.

Troy, N. Y.—(Special.)—Geo. B. Fales says a special committee of the common council has reported favorably upon opening and extending Madison avenue, Dunham and Hawthorne streets.

Springfield, Mass.—Action is being urged on the proposed construction of the South End boulevard. E. H. Barney and Daniel J. Marsh, of the park commissioner, are interested.

Los Angeles, Cal.—A petition was filed with the city clerk, March 18, asking that S. Truman street, from Downey avenue to Hellman street, be graveled and curbed and sidewalks constructed.

Lapeer, Mich.—Reports of March 12 state that investigations regarding paving material for Nepessing street thus far are in favor of crushed stone or vitrified brick.

Lima, O.—Petitions were presented to the Council March 16 for paving North and Main streets with brick.

Monmouth, Ill.—The question of extending the hard roads is being agitated, and is particularly favored in Hale township.

Norfolk, Va.—The residents of Brambleton ward will vote May 27 on the question of issuing bonds for street improvements.

Newtown (L. I.), N. Y.—A special election will probably be held April 6 to vote on issuing $400,000 in bonds for macadamizing roads.

Hamden, Conn.—This town voted March 22 to macadamize a mile of Circular avenue. John H. Davis, H. D. Johnson, Patrick Nolan, selectmen.

Topeka, Kas.—The legislature has appropriated $16,600 for surfacing the drives and walks in the State House grounds with asphalt.

Detroit, Mich.—The estimated cost of paving Market Block, 9,112 square yards, with asphalt on concrete, is $25,060. John McVicar, President Board Public Works.

Chicago, Ill.—Asphalt paving is contemplated for N. Clark street, from Kinzie street to Lincoln Park or North avenue. Alderman Walker of the Twenty-fourth ward is interested.

Bourne, Mass.—An appropriation of $33,000 has been voted to build a section of shore road from Buzzard's bay to Monument beach. O. R. Swift, clerk.

Niagara Falls, N. Y.—Paving is favored by the property-owners on Michigan street, and a petition will be presented to the Common Council asking for it.

Omaha, Neb.—A petition will be filed by the property-owners for asphalt paving on Sixteenth street, from Howard street to the northeast end of the viaduct.

Chicago, Ill.—The associated cycling clubs have asked the City Council to resurface Michigan avenue, from Jackson to Pine streets, with asphalt.

Liberty, Ind.—The question of constructing the Greentown and Plevna gravel road, about twelve miles long and costing $25,000, will be voted on.

Baraboo, Wis.—The farmers are taking action toward procuring better roads. A meeting was held in this city March 23 to discuss the question.

Marion, O.—A petition will be presented to the city council asking that Bellefontaine avenue, from Prospect to Windsor street, be macadamized and curbed.

Long Island (L. I.), N. Y.—The Queens county supervisors have authorized the issue of $496,000 bonds for macadamizing county roads. County Engineer McLaughlin.

Rochester, N. Y.—An important street improvement contemplated for this summer is the repaving with asphalt of Monroe avenue, from Alexander to Goodman street.

Flushing (L. I.), N. Y.—The question of issuing $122,000 bonds for macadamizing streets in Bayside, Douglaston and Little Neck, will be voted on.

Lisbon, O. (Special.)—Cyrus W. Pritchard, city clerk, says that this city expects to pave Washington street this year. The contract has not yet been let.

Victoria, B. C.—Mayor Redfern suggests that $100,000 be borrowed for the purpose of constructing macadamized streets, concrete gutters and sidewalks.

Columbus, O.—A petition for the improvement of Sycamore street, from Lathrop street to Parsons avenue, was referred to the director of public improvements March 6.

Baltimore, Md.—Granite block paving is contemplated for Green, Saratoga and Charles streets. Brick paving has been decided upon by the park board for Terrace avenue, from the Madison street entrance to the Druid Hill park, to Druid Hill avenue.

Indianapolis, Ind.—A resolution was adopted March 26 for asphalt paving from North street to Fall creek, and High street from McCarty street to Coburn. Petitions have been filed for cement walks in a number of streets. M. A. Downing, Prest. B. P. W.

Louisville, Ky.—Considerable paving will be done, including the reconstruction of 15,000 square yards of asphalt streets; 5,772 square yards of new asphalt streets; one and one-half blocks of granite streets, and several blocks of vitrified brick paving.

Spokane, Wash.—Three paving ordinances have been adopted, one providing for paving Main avenue, between Post and Division, with vitrified brick; Riverside avenue, between Monroe and Division, with asphalt; and Howard street, between N. P. R. R. tracks and the Spokane river, with Belgian block.

Utica, N. Y.—The council has designated asphalt paving of the best quality for Leah street, between Elm and Steuben; Spring, between Broadway and State, and Union street. The kind of pavement for Taylor avenue, from the West Shore to Archer street, will be decided upon April 2.

Los Angeles, Cal.—The Merchants' and Manufacturers' Association adopted a resolution March 15, forming a plan for the construction of a grand boulevard between this city and Pasadena. Judge Silent is permanent chairman of the committee, and William H. Knight is secretary.

Saginaw, Mich.—The question of paving Jefferson avenue is still unsettled. The street has been ordered paved wth asphalt, but remonstrating property owners, who want cedar blocks, represent the majority, which will probably result in the former action of the council being rescinded.

St. Louis, Mo.—Ordinances were approved by the board of public improvements, March 5, for improving eight streets and grading seven streets. Ordinances were authorized March 12 for improving Goodfellow, Hamilton, Cook, Aubert and Newstead streets, at a cost of about $36,569.

Winona, Minn.—After receiving from a number of cities favorable replies to inquiries as to the advisability of macadam paving on resident streets, a special council committee, composed of D. Sinclair, H. W. Lamberton and H. Choate, has recommended the macadamizing of Broadway.

Northampton, Mass.—The appropriation for highway improvement this year is $20,000, which will be expended in permanently improving the following streets: Maple street, Florence; Center street; road leading from Florence to Leeds; Baker flat from Baker hill to Brickyard hill. L. M. Thacher, city engineer.

Nashville, Tenn.—The board of public works and affairs, on March 20, authorized the enforcement of the sidewalk law on both sides of portions of Vine, Summer, Church and Cherry streets. Bids will be solicited, also for sidewalks on both sides of portions of Boscobel, College and Douglas streets.

Crown Point, Ind.—The board of county commissioners met, March 24, to consider petitions for building eight miles of gravel roads in Hobart township and eighteen miles in Ross township. The new improvements will probably result in the farmers in southern Lake county petitioning for gravel roadways in the Creek township.

Des Moines, Ia.—The council has voted to pave portions of Grand Ninth and Penn avenues, the Saylorville road and E. Ninth, E. First, E. Walnut, Cherry, Pleasant, Center, Franklin and Eighteenth streets. Contracts will soon be let, also for grading in Eighth, Madison, Day, E. Sixteenth, E. Seventeenth and E. Eighteenth streets and Ovid avenue.

Newark, N. J.—Notice of intention was published, March 27, for granite block paving on sand foundation in Lincoln street, from Mercer to Court; brick on 6-inch concrete, Kearny street, from Belleville avenue to Garside street; Jefferson street, from Market to Ferry with granite blocks on sand, and from Ferry to Chestnut with brick on 6-inch concrete.

Chicago, Ill.—The Sheridan drive extension bill was introduced in the house at Springfield, March 19, by Representative Saylor. A similar bill is pending in the Wisconsin legislature, and if both bills pass one of the most magnificent drives in the world will be completed from this city to Green Bay, Wis., and this will eventually be extended to Milwaukee.

Detroit, Mich.—Repaving has been asked for a number of streets by the board of aldermen, as follows: Asphalt—Stimson place; brick, Larned, from Brush to Dequindre; Grand River avenue, 400 feet west of railroad tracks to city limits; Michigan avenue, from west line of Porter farm to Livernois river; cedar blocks, National avenue, Twelfth, Sixteenth, Fourteenth, Howard and Champlain streets.

Kansas City, Mo.—The board of public works authorized, March 9, asphalt paving for Springfield avenue, from Grand to Troost avenue. The south side of the street lies in Westport, and it is probable that the Westport council will have it paved. A petition was submitted to the board, March 16, for a standard asphalt, not to be confined to any one brand, from Tracy avenue, from Ninth to Twelfth streets.

Newark, N. J.—The property-owners on Murray street have petitioned for a Trinidad Lake asphalt pavement, from Clinton avenue to Broad street, or New Jersey Railroad avenue. Surveyor Adam estimates that a bicycle path eight feet wide in the center of Halsey street, constructed of asphalt on the cobblestone pavement, would cost $1,645 and an asphalt path four feet wide on each side of the street would cost the same.

New Haven, Conn.—A resolution has passed both branches of council providing that the board of public works shall advertise for bids and award the contract to the lowest responsible bidder on or before June 1, in all cases where specific appropriations for $500 have been made by the court of common council. Under this resolution specifications are being prepared for the following streets: Hardening Warren Humphrey, Edwards, Arch, Rosette, Chestnut and Lloyd streets, and Derby, Edgewood, Dixwell and Blatchley avenues; grading and curbing Edgewood avenue and gutters on Humphrey street.

New York, N. Y.—The Board of Estimate and Apportionment appropriated $500,210, March 1, for the purpose of paving streets with asphalt. Some of the streets to be paved with asphalt under the appropriation are: Beaver, Exchange place, Dey, Roosevelt, Jay, Bleecker, Market, Charles, Jane, W. Eleventh, W. Fifteenth, W. Nineteenth, W. Twentieth, W. Twenty-ninth, W. Thirty-second, W. Forty-third, W. Forty-seventh, W. Fifty-second, Broadway, from Fifty-eighth-st. to the Circle, E. Fifty-eighth, E. Sixty-third, Columbus avenue, W. Eighty-third, E. Seventy-sixth, E. Eighty-fifth, E. Ninetieth, E. 104th, E. 120th, E. 121st and E. 137th. The plans involve the laying of 151,000 square yards of asphalt.

Indianapolis, Ind.—Papers were ordered prepared, March 12, for asphalt paving on New Jersey street, from Twenty-second to Fall creek; cement walks in Detroit avenue and in New Jersey and New York streets. Resolutions were adopted March 19 for asphalt paving and cement sidewalks on Park avenue, from Massachusetts avenue to St. Clair street, and cement walks on Walnut street, from Alabama to East. Plans were

ordered prepared, March 25, for cement walks on Ohio and Union streets and paving the alley north of Vermont street, from Liberty to Michigan, with brick. Washington street, from Alabama to Senate avenue, will be repaved with asphalt.

New York, N. Y.—Public Works Commissioner Collis submitted to the board of estimate, March 23, a list of streets to be paved with asphalt as soon as the necessary preliminaries are complied with, including the following: Fifth avenue from Eightieth to Ninetieth street; Tenth street from Fifth to Greenwich avenue; Seventy-seventh street from Lexington to Fifth avenue; Seventy-fifth street from First to Fourth avenue; Twenty-first street from First to Third avenue; Seventieth street from First to Lexington avenue; Eighty-sixth street from Fifth to Madison avenue. Seventh avenue will be macadamized from One Hundred and Tenth street to the river.

Newark, N. J.—The board of public works decided, March 18, to pave the following streets this summer: Asphalt—Elm street, from Mulberry to Lang; Milford avenue, from Clinton avenue to Alpine street; Murray street, from Clinton avenue to Broad; Camden street, from Springfield avenue to Thirteenth; Quitman street, from W. Kinney street to Clinton avenue; Court street, from High to Howard; N. Third street, from Warren street to Seventh avenue. Granite blocks—Jefferson street, from Market to Chestnut; Court street, from Washington to Broad; Waverly place, from Somerset street to Belmont avenue; Waverly avenue, from Belmont to Eighteenth avenue; Broome street, from Avon avenue to W. Kinney street; Fairmount avenue, from Fifteenth to South Orange avenue; Court street, from Howard street to Belmont avenue; Montgomery street, from High street to Belmont avenue. Brick—Kearny street, from Belleville avenue to Garside street; Folk street, from Lafayette to Ferry; Warren, from Orange to S. Eighth, and all of Bank street and Wallace place will be paved, but the material has not yet been decided upon. Notice of intention to pave has been ordered.

CONTRACTS TO BE LET.

Thornton, Ill.—Bids will be received until April 3 for macadamizing streets. Carl Puhrman.

Atlanta, Ga.—Bids are asked until April 5 for paving Washington street with asphalt. R. M. Clayton, city engineer.

Spencer, Ind.—Sealed bids will be received until April 12 for constructing pike roads. Joseph B. Workman, county auditor.

Crawfordsville, Ind.—Bids will be received until April 5 for about 600 square yards of brick paving. T. F. Hoffman, city engineer.

Pleasant Ridge, O.—Sealed proposals will be received until April 5 for macadamizing Montgomery road. Bond, $1,000. J. B. Hayden, clerk.

Governor's Island, N. Y.—Sealed proposals will be received until April 9 for constructing about 900 square yards of asphalt paving. Quartermaster.

Lafayette, Ind.—Sealed proposals will be received until April 12 for improving Holloway street, from Washington to Owen. Thomas W. Burt, city clerk.

Lancaster, O.—Sealed proposals will be received until April 12 for constructing sandstone curbing and brick sidewalks. H. T. Mechling, city clerk.

Albany, N. Y.—Sealed proposals will be received until April 15 for repaving with vitrified bricks the Hawk street viaduct. Thomas J. Lanahan, clerk.

Waukesha, Wis.—(Special.)—Sealed proposals will be received until April 12 for paving with brick on concrete base Grand avenue. William Powrie, city engineer.

Minneapolis, Minn.—Bids will be received until April 2 for granite curbing for a fountain to be built in Logan park. J. A. Ridgway, secretary park board.

Meriden, Conn.—Sealed proposals will be received until April 5 for 4,100 square yards of brick paving on Hanover street. Certified check, $300. E. B. Moss, clerk.

New York, N. Y.—Bids are asked until April 2 for improving the center parkways of the Western boulevard where not already improved. C. H. T. Collis, commissioner public works.

Harvey, Ill.—Sealed proposals will be received until April 12, for grading and graveling the central twenty-four feet of One Hundred and Forty-Seventh street, certified check, $1,000. J. C. De Klerk, city engineer.

Tiffin, O.—Sealed proposals will be received until April 3 for curbing and paving Main street, from Jefferson to Hedges street, with brick; bond, $1,000. J. B. Ehrenfried, city clerk.

Annapolis, Md.—Sealed proposals will be received until April 8 for grading, curbing and paving Cornhill street, and the intersection at Market place. John H. Bright, chairman street committee.

Peoria, Ill.—Sealed proposals will be received until April 6 for furnishing 2,000 lineal feet of curbstone to this city; cash or certified check, $200. Will O. Clark, commissioner public works.

Olean, N. Y.—Sealed proposals will be received until April 15 for the construction of 10,000 square yards of vitrified brick pavement, on concrete foundation, in Union street. E. E. Allen, superintendent of streets.

Canton, O.—(Special.)—Bids will be received until April 12 for furnishing materials and labor necessary for the improvement of W. Seventh, E. Tenth, E. Lake and S. Court streets. City Clerk Belding.

Newark, N. J.—Sealed proposals will be received until April 7 for grading and paving with telford S. Orange avenue, from the Rahway river to Cheapside, in Milburn and Livingston townships, a distance of more than three miles; bond, $1,000. Thomas McGowan, director, 800 Broad street.

Terre Haute, Ind.—Sealed proposals will be received until April 6, for curbing and paving with screened gravel and paving sidewalks with gravel screenings, Fourth avenue, from Third to Seventh; bond, $200. Charles H. Goodwin, city clerk.

Napoleon, O.—Sealed proposals will be received until April 3 for grading, curbing and paving with vitrified brick or block, Washington street, from Monroe street to Sheffield avenue, 14,700 square yards; certified check, 5 per cent. James P. Mason, clerk.

Henderson, Ky.—Sealed bids will be received until April 6, for constructing a ten-foot brick sidewalk, with four-foot gutters,

in Center street, from Alyes to Holloway street, and a twelve-foot sidewalk, with foot brick sidewalk, with four-foot gutters, from Elm to Green. John C. Thomasson, city clerk.

Toledo, O.—Sealed proposals will be received until April 5 for paving the alley between Superior and Huron streets with Trinidad pitch lake or Bermudez asphalt, vitrified or other paving blocks, on a hydraulic concrete foundation; deposit, $300. Lem P. Harris, county clerk.

Valparaiso, Ind.—Bids will be received until April 5 for the construction of a stone sidewalk around the four sides of the public square and concrete walks leading from the streets to the court house, the entrances thereto, and around the same. Jas. S. Fulton, chairman board county commissioners.

Davenport, Ia.—Bids will be received until April 7 for paving with brick and curbing Locust street, from Grand to Arlington; Third avenue, from College to Mississippi; Fifteenth street, from Brady to Grand; Main street, from Sixteenth to Locust; brick, $100 each. E. W. Boynton, commissioner public works.

Shreveport, La.—Sealed bids are invited until April 15 for vitrified brick paving on concrete foundation,on the following streets: Texas, street, 23,725 square yards; Common street, 1,445.32 square yards; Milam and Texas avenue intersection, 963.01 square yards; Texas avenue, 105,859.07 square yards; total, 129,990 square yards; certified check $1,000. N. B. Murff, comptroller.

Norwood, O.—Sealed proposals will be received until April 3, for grading, curbing, setting curb and gutters, and paving with brick or asphalt, Montgomery pike, from B. & O. S. W. R. R. bridge to Mound avenue. Bids will be received until April 6 for paving with asphaltum block, setting curb and gutters, etc., Montgomery pike, from Ivanhoe avenue to B. & O. S. W. R. R. bridge; certified check 5 per cent. W. E. Wichgar, city clerk.

Cleveland, O.—Sealed proposals will be received until April 4 for asphalt paving, curbing, etc., in Hamilton and Hickox street, and Woodland and Scranton avenues. Bids will be received until April 16 for brick paving and curbing in Erie, Bunnell, Harmon, Luverne, Sumner and Vine streets. Brick paving is proposed for Lorain road, from the city line to the South Rocky River bridge. D. E. Wright, director public works.

Des Moines, Ia.—Sealed proposals will be received April 2 for curbing as follows: W. Seventh street, 470 lineal feet; Des Moines street, 5,000 lineal feet; E. Lyon street, 5,240 lineal feet; Saylorville road, 1,600 lineal feet; E. Sixteenth street, 736 lineal feet; Eighteenth street, 4,980 lineal feet; Pleasant and Center streets, 1,106 lineal feet. Bids will be received the same date for 970 cubic yards of grading in Sixth avenue; all bids must be accompanied by a certified check of 11 per cent. George C. Sims, E. D. Boardman, board public works.

CONTRACTS AWARDED.

Decatur, Ind.—The contract for building the Decatur and Bluffton macadamized road, twelve miles long, was awarded March 10, to Calvin Miller & Co. of Marion for $34,949.

Flushing, N. Y.—The contracts for macadamizing three sections of roads were awarded to T. F. Byrnes of Brooklyn for $88,352.

Athens, Pa.—The contract for paving Main street has been awarded to the Newark Paving company of Newark, N. J.

Evanstown, Ill.—Jas. Wigging was awarded the contract, March 23, for paving Crain street, from Asbury to Sherman avenue for $8,333.

Sandusky, O.—The contract for paving Hancock street was awarded to J. C. Brennan, who will use Bolen brick with Murphy grout filler.

Johnstown, Pa.—The contract for constructing the Johnstown and Cramer turnpike has been awarded to Theodore Keenan & Son of Hollidaysburg, Pa.

Albany, N. Y.—T. Henry Dumary was awarded the contract for repaving Knox street, from State street to Washington avenue with brick for $3,590.88.

New Orleans, La.—The Barber Asphalt Paving company has been awarded the contract for paving Jackson avenue, from St. Charles to Prytania street with asphalt.

Madison, Ind.—The contract for building twenty miles of free pike road was awarded to Byrne & Deal of Seymour; estimated cost, $30,000.

Utica, N. Y.—The contract for paving State street was awarded, March 12, to the Warren-Scharf Asphalt Paving company at $1.48 a square yard and Seneca street at $1.39.

La Crosse, Wis.—The contract for paving Avon-st., from Clinton to Gillette was awarded, March 5, to R. F. Weston at $1.45 a running foot before residences and $3 for crossings.

Bellefontaine, O.—(Special)—W. C. Zearing, city clerk, says that only one bid was received March 9 for paving Detroit street, which was from W. T. G. Snyder. The contract has not yet been awarded.

Alton, Ill.—The contract for paving and guttering Front street, from Market to Ridge, 10,000 square yards, was awarded, March 13, to Wolf, Maupin & Curdie of this city. Alton brick will be used.

Rochester, N. Y.—Bids were received, March 15, for paving State street, between Center and Jay, with asphalt, but, owing to an injunction which has been secured by the Rochester Railway company, the contract was not awarded.

Columbus, O.—W. H. Luchtenberg secured the contract, March 8, for paving Jones avenue, on the west side, at 77 cents a square yard for repressed block. The contract was let for 12 cents less a square yard than any street paving contract ever before let in this city.

Hamilton, O.—The contract for paving High street, from the High street bridge east to the C., H. & D. tracks, has been awarded to B. D. Bartow & Co. at $2.16 a square yard for block asphalt on concrete, or a total of $41,042.50. The bids were received Feb. 15.

Rochester, N. Y.—Bids were received, March 16, for paving State street, from Central avenue to Jay street, with brick, but the contract has not yet been awarded. Bids were submitted by the Rock Asphalt Pavement company, the Rochester Vulcanite Pavement company and the Warren-Scharf Asphalt Paving company.

Boston, Mass.—The contract for furnishing granite blocks for the year was awarded, Feb. 25, to the Rockport Granite company at $44.90 a thousand. The blocks are known as "large Bostons" and are 10 to 14 inches long, 3½ to 4½ inches thick and 7½ to 8 inches deep.

Montgomery, Ala.—The contract for 20,250 square yards of brick paving in seven streets was awarded, Feb. 15, to the J. H. Talbot Paving company at the following prices: Granite curb, 40 cents a lineal foot; abutment stones, 55 cents a lineal foot; iron gutter covers, $5 each; brick paving, $1.48 a square yard; total, $30,654.

Omaha, Neb.—The contract for repaving S. Sixteenth street was awarded, Feb. 20, to Hugh Murphy at the following prices: Asphalt, class A, 2½-inch asphalt on 6-inch concrete, $1.95¼; class C, 2½-inch asphalt on 4½-inch concrete on old wooden blocks, $1.63; vitrified brick, $1.35.

Washington, D. C.—The Barber Asphalt Paving company will pave the following streets: I street, northwest, between Twenty-third and Twenty-fourth; Third street, southwest, between H and I streets; G street, northeast, between Maryland avenue and Fourteenth; E street, southeast, between Thirteenth and Fourteenth; M street, northwest, between Thirty-first and Thirty-second streets, Georgetown.

Scranton, Pa.—The contract for paving Mulberry street was awarded, March 11, to the Columbia Construction company, of Syracuse, N. Y., at their bid of $1.95 a square yard for land asphalt. The bids for this work were received Feb. 18, the other bids being as follows: Barber Asphalt Paving company, $2.52; Dunn Bros., $2.54; August Robinson, $2.43 and $2.10.

York, Pa.—Contracts have been awarded for thirty-six blocks of paving, as follows: J. U. Fritchey, Lancaster, Pa., Hallwood and Mack block, on macadam, $2.60 a square yard; on concrete, $2.90. Ward & Stucker, Harrisburg, Pa., Guise vitrified brick, on macadam, $2.60; concrete, $2.98. Odewald & Huber, Clearfield, Pa., vitrified brick or block, on macadam, $2.62; concrete, $2.92.

Newark, N. J.—The contract for constructing a Telford pavement on Mount Pleasant avenue was awarded, March 8, to W. J. Whittaker, at the following prices: Paving, 46 cents a square yard; excavation, 25 cents a cubic yard; underdraining, 20 cents a square foot. Osborn & Marcelis secured the contract for the Little Falls road: Telford paving 44½ cents; excavation, 22 cents; underdraining, 30 cents.

Oswego, N. Y.—(Special.)—F. J. O'Brien, superintendent department public works, says the contract for paving W. First street, from Bridge to Utica, was awarded to the Warren-Scharf Asphalt Paving company at $2.25 a square yard for asphalt and $2.35 for brick between the street car tracks. The contract for brick paving in E. Utica street was awarded to John Henrick, city, at $2.10 a square yard for Mack block.

Racine, Wis.—Contracts were awarded March 5 as follows: George Keith, Lansing, Mich., grading Northwestern avenue and State street. Mapes, Read & Meagher, Bay City, Mich., paving, cedar blocks, Northwestern avenue, 64½ cents outside the street car tracks; 65 cents inside street car tracks; curbing, 21½ cents a lineal foot; State street, 65 cents outside tracks; 66 cents inside tracks; curbing, 42½ cents.

Winnetka, Ill.—The Ruddy Construction company of Chicago secured the contract, Feb. 25, for 50,580 square yards of macadam paving at the following prices: Macadam, 65 cents; brick gutters, 6,040 square feet, 15 cents; wood curb, 32,000 feet, 13 cents; 8-inch sewer, 1,985 feet, 15 cents; fifty-eight catch basins, $20 each; three manholes, $20 each; overhaul 300 to 800 feet, 100 yards, 20 cents; overhaul extra, 100 feet, 10 cents; total, $40,175.

Kansas City, Mo.—The contract for paving Guinotte avenue, from Lydia to the brewery, has been awarded to A. J. Armstrong at 76 cents a square yard, or $12,236 for the whole. The pavement will be of macadam. M. Mense secured the contract for paving Fourth street, from Walnut to Grand, with brick, for $1,372, and P. C. Fielding the contract for grading Mercer street, from Eighteenth to Cliff, for $1,662.

Brooklyn, N. Y.—Cranford & Co. presented the lowest bids March 22 for asphalt repaving, at $1.07 a square yard, aggregating the following: Hewes street, from Bedford to Marcy avenues, $7,531.99; concrete foundation, $8,780.49. Throop avenue, from Green to Stuyvesant, concrete foundation, $19,755.20; Penn street, from Marcy to Harrison, concrete foundation, $5,790.45; Roos street, from Lee to Marcy, concrete foundation, $6,461.10; Market street, from Jamaica to Atlantic, $28,285.45.

Atlanta, Ga.—Bids were received March 15 for paving as follows: Forsyth street, brick—Georgia paving company, $1.81 a square yard; Tennessee Paving Brick company, $1.85. Asphalt—Warren-Scharf Asphalt Paving company, $2.63, including concrete. Granite blocks—Williams Block Pavement Investment company, $1.85; John Bradley, $1.86; Venable Bros., $1.84; Grant Wilkins, $2.66 8-10; Wilby Mayor & Co., $1.82. Bartow street—Grant & Wilkins, granite blocks, $1.67; Doby & Robertson, Lithonia, $1.28; John Bradley, $1.01¾.

Davenport, Ia.—(Special.)—E. W. Boynton, commissioner of public works, says contracts were awarded March 20 for 13,000 square yards of brick paving on concrete, and 6,600 square yards on macadam, as follows: Edward & Walsh Construction company—Third avenue, from Mississippi to College avenue, repressed brick on 4 inches of macadam and 3 inches of sand, $1.07 a square yard; concrete curb, 5x18, 32 cents a lineal foot; drain tile, 3-inch, 9 cents a lineal foot. Flick & Johnson Construction company—Fifteenth street, from Brady to Grand avenue, repressed brick on 5 inches of concrete and 2 inches of sand, $1.18 a square yard; concrete curb, 5x18, 34 cents; drain tile, 9 cents. Wm. Horrabin—Main street, from Sixteenth to Locust, repressed brick, on 4 inches of macadam and 3 inches of sand, 99½ cents a square yard; concrete curb, 5x18, 28 cents; drain tile, 8 cents; Locust street, from Grand to Arlington avenue, repressed brick on 5 inches of concrete and 2 inches of sand, $1.23 a square yard; concrete curb, 28 cents; drain tile 8 cents.

New York, N. Y.—(Special.)—Bids were received by the department of public works March 18 for asphalt paving laid over stone

block pavements as follows: Bank street, from Green to Bleecker street; Fourth street, from Second avenue to Broadway; Thirty-ninth street, from First to Fourth avenue; Thirtieth street, from Sixth to Tenth avenue; Thirty-sixth street, from Sixth to Ninth avenue; Forty-first street, from Eighth to Eleventh avenue; One Hundred and Twenty-ninth street, Boulevard to Manhattan avenue; West End avenue, intersection of One Hundred and Fourth street; Fifth street, Ave. C to Ave. D; Sixth street, Ave. D to Ave. B; Ave. D, from Houston street to Eleventh street; Eleventh street, Ave. D to Second avenue; One Hundred and Twenty-sixth street, from St. Nicholas avenue to Lawrence street; One Hundred and Twenty-sixth street, from Lawrence street to Boulevard; Thirty-ninth street, from Eighth to Eleventh avenue. The opening of the bids was postponed to a date to be announced later. Chamber street, from Broadway to Center street, was awarded to the Barber Asphalt Paving company on March 15 for a guarantee of ten years. Maintenance contracts were let for a portion of Seventh street and a portion of Lexington avenue and awarded to the Sicilian Asphalt Paving company.

SEWERS.

Milwaukee, Wis.—Commissioner Schneider of the board of public works stated March 6 that the action of the legislature regarding the sewerage taxation bill has rendered it necessary to abandon all plans for extension of sewers. The intercepting sewer will probably be discontinued when it is completed as far north on Thirtieth street as Vliet street.

Kansas City, Mo.—The board of public works has adopted a rule requiring all sewer contractors to deposit with the city an amount of money equal to 5 per cent. of their contracts before the tax bills are issued to them, the deposit to remain with the city comptroller for six months to insure that the contractors will properly repair all streets they tear up.

Chicago, Ill.—Sewer contractors will ask the council to repeal the ordinance passed in November, 1896, requiring that iron pipe be used in all sewer work inside of lot building lines. Iron pipe costs about four times as much as the vitrified brick sewer pipe, and will not, the contractor claims, last longer than ten years while vitrified sewer pipe will last fifty years. They also claim that the ordinance practically gives several manufacturers of iron sewer pipe a monopoly of the business.

CONTEMPLATED WORK.

Westfield, Mass.—A surface sewerage system is proposed.

Lisbon Falls, Me.—A sewer will be constructed in Main street.

Painesville, O.—Bonds will be issued for a sewerage system.

Richwood, O.—A sewerage system is contemplated by the Council.

Stockton, N. J.—A sewerage system is being agitated for this place.

Palo Alto, Cal.—C. E. Moore is preparing plans for a sewerage system.

Sherburn, Minn.—The new Council contemplates putting in a sewer soon.

San Jose, Cal.—The construction of a main relief sewer is contemplated.

Wakefield, N. Y.—The question of a sewerage system is being considered.

Sea Cliff (L. I.), N. Y.—The construction of a sewerage system is contemplated.

Fall River, Mass.—The extension of the outlet sewers to tidewater is proposed.

Akron, O.—Ordinances have been adopted for constructing sewers. F. C. Wilson, city clerk.

Covington, Ind.—The City Council decided March 11 to put in a sewerage system.

West Newton, Pa.—Surveys for a sewerage system will be made by W. L. Eicher, of Charleroi, Pa.

Barnesville, Minn.—The question of constructing a sewerage system is being agitated.

New Britain, Conn.—A sewerage system, at a cost of $32,500 is proposed.

South Haven, Mich.—The question of constructing a sewerage system is being agitated.

Crookston, Minn.—The citizens of the Third ward are endeavoring to secure sewer privileges.

Lachine, Que.—Plans will be presented soon for a sewerage system. Joseph A. Descarrius, mayor.

New Brighton, Pa.—The borough council will receive bids for a plan of sewerage for this town.

Los Gatos, Cal.—An issue of bonds for the construction of a sewerage system is contemplated.

Winona, Minn.—The plans and specifications for constructing a second sewerage system have been completed.

Vincennes, Ind.—The construction of a sewerage system is seriously contemplated. Mayor George E. Greene.

Columbia City, Ind.—Plans for a sewerage system are being made by Phillips & Goss, Martinsville, Ind.

Fredericksburg, Va.—Plans for a sewerage system are being made by Wilson Davis, of Charlottesville, Va.

Ironton, O.—An ordinance has been adopted by the council for the extension of the sewerage system.

St. Paul, Minn.—A final order has been passed for a sewer on Jackson street, from Grove to Thirteenth.

Quincy, Ill.—An ordinance has been adopted for a pipe sewer in Front street, from Delaware to Washington.

Lamberton, N. C.—The question of constructing a sewerage and water works system will be voted on April 15.

Philadelphia, Pa.—An appropriation of $300,000 for main sewer construction was voted by councils, March 11.

South Bend, Ind.—Plans and specifications will be prepared for a sewer in Sample street. William M. Whitten, city engineer.

Dunmore, Pa.—The question of constructing a sewer system is being considered by the mayor and council.

Grass Valley, Cal.—The construction of a sewerage system is under consideration by the board of trustees.

Webster City, Ia.—Plans are being prepared for a sewerage system for this city by E. E. Fox, civil engineer, Chicago, Ill.

Woonsocket, R. I.—Ordinances have been passed authorizing the construction of a number of sewers. F. H. Mills, city engineer.

Weston, W. Va.—A survey has been made of this town by Col. Thomas Pettigrew with a view to constructing a sewerage system.

Pontiac, Mich.—H. E. Riggs, civil engineer of Toledo, O., will superintend the construction of a sewerage system in this city.

Eau Claire, Wis.—The council contemplates the construction of a sewer in Gilbert avenue, from S. River to S. Farwell street.

Warren, O.—The construction of 2,200 feet of 12-9-inch pipe sewer is contemplated for this summer. Homer C. White city engineer.

Webster, Mass.—A change will be made in the plans of the sewerage system, which is to be submitted to the voters in April.

Somerville, Mass.—The construction of a storm sewer system is contemplated; estimated cost, $45,000. E. W. Bailey, city engineer.

Clinton, Mass.—The sum of $10,000 was voted March 1 for the construction and maintenance of sewers. J. Thissell, city engineer.

Baltimore, Md.—An ordinance appropriating $6,000 for a sewer in Elbow lane has been passed by the council. William A. Hanway, city commissioner.

Winona, Minn.—Governor Clough has vetoed the bill to allow this city to issue bonds for building a second sewerage system this spring.

Boston, Mass.—An ordinance was introduced March 9, appropriating $100,000 for the construction of the West Roxbury low-level sewer.

Ann Arbor, Mich.—The preparation of plans and specifications is recommended for a sewer in district No. 6. John Koch, commissioner on sewers.

East Cleveland, O.—The question of issuing $100,000 in bonds for sewer construction will be voted on April 5. H. B. Chapman, village clerk.

Boston, Mass.—An ordinance has been introduced into the council appropriating $75,000 for the construction of the Canal street relief sewer.

Norfolk, Va.—The question of issuing bonds for street and sewer improvements in Brambleton road will be submitted to the voters May 27.

Guadalajara, Mex.—An appropriation of $100,000 has been made for the construction of about twenty-five miles of sewers in the western part of the city.

Pana, Ill.—The city council is about ready to invite bids for constructing about 6,865 feet of twenty-four, twenty, sixteen-inch sewer. Fred M. Elliot, city clerk.

Troy, N. Y.—Resolutions were referred to the sewer committee March 18 for sewers in Howard, Thompson and Erie streets, and Grant, Sherman and Sheridan avenues.

Pittsburg, Pa.—Ordinances have been approved for sewers in Monongahela, Sickler, Allison and other streets and avenues. W. C. Gearing, Clerk Common Council.

Cumberland, Md.—A petition has been presented to the Council by the Chapel Hill Improvement Company for permission to build a sewerage system on Chapel Hill.

Oswego, N. Y.—(Special.)—F. J. O'Brien, superintendent department of public works, says plans have been made for a 15-18-inch pipe sewer from the river to E. Fourth street.

Memphis, Tenn.—The citizens of Madison Heights are urging the need of sewers. Dr. A. L. Elcan is chairman of the committee that is considering the question.

Joplin, Mo.—A special election has been ordered for April 13 by the City Council to vote on issuing $5,000 in bonds for the extension of the main outlet sewer.

Denver, Col.—T. J. Milner, chief engineer, has been authorized by the Board of Public Works to prepare plans and estimates for the proposed system of storm sewers.

Everett, Mass.—The construction of a trunk sewer, to connect the North Everett sewer with the Metropolitan sewer at Malden, is contemplated. C. W. Mason, city engineer.

Atlanta, Ga.—An ordinance is in the Council for a 2x3 feet egg-shape brick and stone sewer in Mitchell street, and a 24-inch pipe sewer in Markham and Davis streets. W. D. Green, city clerk.

New Britain, Conn.—The Common Council will, it is thought, order a sewer in the southeastern section of this city which, with laterals, will cost about $40,000.

Springfield, Ill.—A committee was appointed March 1 to make a report to the village board of West Springfield regarding estimates, etc., for building a sewerage system.

Jamestown, N. Y.—John P. Force of Fostoria, O., has been engaged as consulting engineer on the proposed sewer work, which includes a main sewer and sewage disposal works.

Detroit, Mich.—Sewers will be constructed through several blocks. Estimates will be submitted for the extension of the brick public sewer on Van Dyke avenue. John McVicar, president Board Public Works.

Marion, O.—The contract will probably be let soon for the Silver street sewer, the county commissioners having approved the report of H. J. Hill, Engineer, on it; estimated cost, $84,000.

Troy, N. Y.—The public improvement commission authorized Engineer Hayes, March 15, to prepare for a new system of sewerage that would empty all sewage at one point, if possible.

Greenville, O.—A committee of taxpayers has urged the council to submit to a vote of the people the question of issuing $85,000 5 per cent. bonds for a complete sewerage system.

La Crosse, Wis.—The construction of intercepting sewers in Second, Front and State streets has been recommended to council by the commissioner of public works. Frank G. Powell, City Engineer.

Minneapolis, Minn.—The council committee on sewers has voted to recommend the construction of sewers in portions of Grand, Twenty-first and Eighteenth streets, and Second, Sixteenth and Twentieth avenues.

Grand Rapids, Mich.—Approximate estimates were submitted March 6 by Engineer Ames to the board of public works of the cost of constructing sewers in that part of the city known as Silver Creek valley.

Newark, N. J.—Notice of intention has been published by the board of street and water commissioners of the proposed construction of pipe sewers in Warren street and Central avenue, Waverly Place, Ninth avenue, S. Ninth, S. Seventeenth, Crane, Cutler, S. Eleventh and Hunter streets and Mt. Prospect avenue. J. S. Mundy, general superintendent works.

Jamaica (L. I.), N. Y.—This village has voted to construct a sewerage system and disposal works at an estimated cost of from $115,000 to $150,000 and an annual cost of $1,200 to $1,500 for maintenance.

South Orange, N. J.—The plans submitted by Fred F. Crane, engineer, for a sewerage system have been approved by the board of trustees. West Orange and Irvington will be asked to join in building a trunk sewer.

Far Rockaway, N. Y.—The bill introduced in the legislature providing that this village may issue bonds for an additional $5,000 for the completion of the sewerage system, which was begun last year, has become a law.

Providence, R. I.—The committee on sewers voted, March 19, to order sewers in Henderson, Smith, Violet, Ayrault, Whitewash, Oxford, Miner, Carter, Vineyard, Friendship, Filmore Oregon, Bacon and Randall streets and Lexington, Atwell's and Huntington avenues.

Indianapolis, Ind.—Papers were ordered prepared, March 20, for a sewer in Newman street, from Nineteenth to Hill avenue. A resolution was adopted, March 24, for a local sewer in Tacoma avenue and the alleys east and west from Washington to New York street.

Kansas City, Mo.—The finance committee has recommended an ordinance appropriating $13,000 to build another section of the O. K. creek sewer, to extend from the present terminus at Twenty-third and Broadway to Grand avenue, where the east section ends.

Milton, Mass.—An appropriation of $10,000 for a sewer on the line of Blue Hill boulevard, from Brook road to Neponset river was adopted, March 5, and $1,500 for extending the Adams street sewer to connect with the metropolitan sewer. Thomas J. Randall, superintendent of streets.

New Haven, Conn.—The sewer committee voted, March 16, to recommend that sewers be constructed in Bond street, from Congress to Columbus avenue; Haven street, from Grand avenue to Exchange street; Spring street, from Edgar to Liberty; Liberty street, from Spring to Putnam. These sewers will be built out of an appropriation of $50,000, the last of the $5,0,0,0 issue of sewer bonds, which were issued some years ago.

CONTRACTS TO BE LET.

Bedford, Ind.—Bids will probably be asked about May 1 for a sewerage system. J. M. Henderson, city engineer.

Crawfordsville, Ind.—Bids will be received until April 5 for 400 feet 15-inch and 170 feet 10-inch pipe sewers. F. Hoffman, city engineer.

Newark, N. J.—The board of works authorized, March 23, that bids be invited for pipe sewers in Crane, Liberty, S. Ninth, S. Seventeenth and Warren streets.

Oil City, Pa.—Bids will be received until April 6 for furnishing sewer pipe and castings during the year commencing April 6, 1897. S. W. Barnhart, controller.

Albany, N. Y.—Sealed proposals will be received until April 5 for constructing about 1,460 feet of 24-inch and 1,120 feet of 18-inch pipe, with trenches from 10 to 24 feet depth, in Third, Judson and Second streets. Thomas J. Lanahan, clerk.

Lawrence, Kas.—Sealed proposals will be received until April 5 for constructing a vitrified brick storm water sewer; certified check, 10 per cent. A. G. Honnold, city clerk.

Cincinnati, O.—Sealed proposals will be received until April 12 for constructing trunk sewers from Clifton avenue to Bates' run sewer and in Bloody run. A. P. Butterfield, clerk.

Harrison, N. J.—Sealed proposals will be received until April 6 for the construction of a pipe sewer in Grant avenue and New street; certified check, 5 per cent. B. P. Walsh, town clerk.

Niagara Falls, Can.—Sealed proposals will be received until April 5 for the construction of sections 3, 4, 5, 6 and 7 of the sewerage system; certified check, 6 per cent. John Robinson, clerk.

Baltimore, Md.—Bids are asked until April 15 for furnishing about 25,000 brick and 760 lineal feet of invert blocks for the reconstruction of Mosher and John street sewer. W. A. Hanway, county commissioner.

Moores, Pa.—Sealed proposals will be received until April 15 for furnishing and laying about 5,200 feet of 8 to 24-inch pipe sewer, manholes, flushtanks, etc., in Prospect Park, Pa.; certified check, $500. John C. Tullock, chairman sewer committee, Moores, Pa.

Baltimore, Md.—Sealed proposals will be received until April 22 for furnishing the vitrified bricks, invert blocks, hand-made and machine-made bricks, stone, sand, cement, cast iron pipe, etc., necessary to construct the Stricker street sewer. W. A. Hanway, city commissioner.

Warren, Pa.—(Special.)—Sealed proposals will be received until May 5 for constructing portions of the sewer system for the Fifth and Sixth wards, and for furnishing brick, pipe, etc., to be used in connection therewith. D. F. A. Wheelock, city engineer; R. G. Mead, chairman sewer committee.

Chicago, Ill.—Bids will be received until April 7 for building the northern lake district of the intercepting sewer system. The specifications divided the district into three sections. The plans and specifications for the southern lake front district will not be ready before May 1.

Frankfort, Ind.—(Special.)—Bids will be received by the common council until April 5 for constructing about 6,300 feet of 10, 8 and 6-inch sanitary sewers, with manholes, flushtanks, etc.; bids will be received until April 14 for about 600 feet of 12-inch sewer. Alonzo J. Hamond, city engineer.

CONTRACTS AWARDED.

Nashville, Tenn.—The contract for a sewer in East Nashville was awarded, March 16, to Perry & Smith, for $4,090.90.

Cleveland, O.—Wilson & Strack, of Cincinnati., presented the lowest bid for the first section of the Walworth run sewer, which was $116,588.

Grenada, Miss.—The contract for waterworks, sewerage and electric light system was awarded March 12, to J. N. Hazelhurst & Co., of Atlanta, for $36,783.

Frankfort, Ind.—The contract for sewer construction, including 10, 8 and 16-inch connections, has been awarded to E. Nicholson, of Kalamazoo, Mich.

Memphis, Tenn.—The contract for furnishing this with sewer pipe and vitrified brick during the year, was awarded to Pat Bannon & Co., of Louisville, Ky.

Austin, Tex.—C. A. Newning secured the contract, March 3, for furnishing sewer pipe, at the following prices: 15-inch, 36 cents; 18-inch, 54 cents; 20-inch, 74 cents; 24-inch, $1.09.

Mishawaka, Ind.—Sewer contracts were awarded Feb. 16, as follows: Spring street, brick sewer, Hess, Schmidt & Suders, city, $2,338.87.; Main street, pipe sewer, Robert, Hoban & Roach, of South Bend, Ind., $7,-755.44.

Waterbury, Conn.—Alex S. Traub of New York City was awarded the contract March 18 for constructing pipe sewers as follows: 12-inch pipe, 90 cents; 10-inch, 70 cents; 8-inch, 65 cents; manholes, 13, $22.50 each; catch basins, 2, $91 each; total, $1,652.

Toledo, O.—William McMahon was the lowest bidder, March 15, for 1,410 feet of 2-foot sewer, with five manholes and six catch basins, in Scottwood avenue, from Acklin to Delaware, at 90 cents a foot, and G. H. Bodette for 240 feet with one manhole at 67 cents a foot.

Newark, N. J.—Bids were received March 25 for constructing a brick sewer in S. Fourteenth street, from Springfield to Eighteenth avenue, and the contract was awarded to P. Harrison & Son of New York City for $2,910. The work includes 700 feet of brick sewer, 3 feet by 4 feet, four monholes with iron heads and covers and four catch basins, complete, with solid granite heads and sills.

Cedar Falls, Ia.—The contract for constructing a sewerage system was awarded March 15 to J. L. Blocsk of Des Moines, at the following prices: 1,660 lineal feet 8-inch, 49 cents; 1,040 lineal feet 10-inch, 45 cents; 2,966 lineal feet 12-inch, 54 cents; 4,380 lineal leet 15-inch, 91 cents; 1,068 lineal feet 18-inch, 61 cents; 34 manholes, $44 each; 1 lamp hole, $10; 36 house connections, $6; total, $9,001.

Brooklyn, N. Y.—John J. Creem was the lowest bidder, March 16, for constructing a main relief sewer in Clinton avenue, section 2, as follows: 48-inch iron pipe, $2 a lineal foot; 48-inch brick sewer, $4.95 a lineal foot; brick work, laid, $9 a cubic yard; piling, 12 cents a lineal foot; yellow pine caps, per 1,000 feet, $30; Portland cement, $6 a cubic yard; American cement, $3.50 a cubic yard; manholes, complete, $25 each; street basins, complete, $93 each; foundation plank, $17 per 1,000 feet.

Sheboygan, Wis.—(Special.)—A. Lutze, chairman board public works, says the contract was awarded March 15 for sewers to Richard Nommensen, city, as follows: N. Fifth street, from Washington court to Pennsylvania avenue, steel, 48-inch, $4.50 a lineal foot; N. Fourth street, from New York to Pennsylvania avenue, brick, 48-inch, $2.50 a lineal foot; Pennsylvania avenue, from Sixth to Third street, brick, 30-inch, $2 and 24-inch, $1.45; Center street, from Sixth to Fourth, pipe, 20-inch, $1.10; 18-inch, $1; 12-inch, 60 cents; 10-inch, 55 cents; manholes, $22 each; total, $4,742.50.

Atlanta, Ga.—The contract for constructing sewers for the year was awarded March 15 to Davis Smith at the following prices: Brick, $8 per 1,000; rubble, $1 per cubic yard; cut stone, $1 per cubic foot; flagging, 65 cents a square foot; lumber, $7.50 per 1,000; excavation, 10 feet deep and less, 17 cents a cubic yard; excavation, 15 feet deep and less, 21 cents a cubic yard; excavation, 20 feet deep and less, 16 cents a cubic yard; excavation, 25 feet deep and less, 15 cents a cubic yard; concrete, 50 cents a cubic yard; rock excavation, 50 cents a cubic yard; laying 8, 10, 12-inch pipe, 8 cents a lineal foot; laying 15, 18-inch pipe, 6 cents a foot; laying 20, 22 and 24-inch pipe, 8 cents a foot. The contract for cement was awarded to Sciple & Sons at 51 cents a 100 pounds.

WATER-WORKS.

Omaha, Neb.—A proposition to purchase the water works plant will be voted on in April.

Cicero, Ill.—The qestion of municipal ownership of water, gas, etc., will be voted on early in April.

Allegheny, Pa.—A satisfactory test was made of the new pumps at the Montrose pumping station March 8.

Montgomery, Ala.—The question of purchasing the present water works or building a new system is being considered.

Helena, Mont.—Captain James H. Mills of Deer Lodge was appointed receiver of the Helena Consolidated Water Company March 16.

CONTEMPLATED WORK.

Duquoin, Ill.—Plans have been completed for a water works system. Mayor Dunn.

Cumberland, Md.—The water board has recommended the construction of a filtration plant.

Waltham, Mass.—The purchase of new water works contemplated; estimated cost, $24,000.

Lincoln, Mass.—An appropriation of $10,000 has been voted to improve the water works.

Cherry Valley, N. Y.—The question of issuing $4,000 to complete the water works will be voted on.

Fremont, O.—The question of procuring an additional and pure water supply will be voted on in April.

Ft. Wayne, Ind.—The water supply will be increased this summer by putting down more wells.

Rochester, N. H.—This town has asked to have its charter amended so that it may construct a waterworks system.

Ogdensburg, N. Y.—The plans and specifications for the proposed waterworks have been approved by the council.

Plano, Tex.—Surveys, plans, etc., are being made for water works for this place, by J. S. Thacher, of Dallas, Tex.

Ravena, N. Y.—A committee has been appointed to investigate the securing of a water supply. V. L. Diston, town clerk.

Coffeyville, Kas.—The plans and specifications for water works will be completed about April 1. J. M. Walker, city engineer.

East Cleveland, O.—The question of issuing $40,000 in bonds for constructing additional water works will be voted on April 5.

Chagrin Falls, O.—Bids will soon be advertised for the construction of a water plant. L. E. Chapin, Canton, O., engineer.

Dexter, Mo.—The purchase of two five-thousand-gallon pumps and two 16 by 60 boilers, hydrants, pipes, etc., is contemplated. Isaac S. Smith, Chester, Ill., engineer.

Newton, Kas.—This city contemplates building six and one-fourth miles of pipe line pumps, boilers, etc. P. M. Hoisington, chairman water committee.

Olathe, Kas.—Governor Leedy signed the act, March 15, appropriating $12,000 for the completion of the water works system in this city.

Traverse City, Mich.—George W. Rafter, C. E., Rochester, N. Y., has been chosen for consulting engineer for the proposed water works system.

Shushan, N. Y.—A committee of three has been appointed to investigate the question of securing water works; W. L. Thompson, chairman committee.

Council Bluffs, Ia.—A committee has been appointed to investigate the question of securing an additional water supply. Aldermen Bartow, Graham and Hart, committee.

Westfield, Mass.—The question of issuing $100,000 in bonds for building a reservoir at Granville to increase this town's water supply, will be voted on in April.

Water works systems are being agitated for the following places: Mystic, Ia.; Mt. Vernon, Ia.; Oakland, Ill.; Augusta, Wis.; Waterville, Minn.; Dillon, S. C.; Holland Patent, N. Y.

South Glastonbury, Conn.—A committee, consisting of F. D. Glazier, H. A. Kinne, L. W. Howe and A. W. Crane, has been appointed to investigate the question of securing a water supply.

Frederick, Md.—Alexander Potter, C. E., 137 Broadway, New York City, has made a preliminary survey and submitted estimates of the probable cost of increasing the water supply of this city.

Charlottesville, Va.—The council has adopted a plan for an additional water supply by erecting a pump on the Rivanna river of 100,000 gallons capacity and pumping to a standpipe about three miles distant.

Water works have been favorably voted on at the following places: Fosston, Minn.; Perham, Minn.; McMinnville, Tenn.; Northwood, Ia.; LeRoy, Minn.; Coatesville, Pa.; Rogersville, Tenn.; Delaware City, Del.; Ellisville, Miss.

The question of issuing bonds for water works will be voted on as follows: Monticello, Fla., April 5; Lamberton, N. C., April 15; Escanaba, Mich.; White Sulphur Springs, Mont.; Rich Hill, Mo., April 6; Florence, Col. Mayor Lewis, Hellertown, Pa.

Lockport, N. Y.—The water committee is desirous of hearing about the different systems of procuring water supplies. The town is 370 feet above Lake Ontario. Joseph Dumville, chairman committee.

Water works extensions are contemplated at the following places: Winthrop, Minn.; Westport, Mo.; Hamilton, Ont., Canada, chairman, Dixon; Berkstone, Mass.; Brockton, Mass.; Wellesley, Mass.; Worcester, Mass.; Fort Washington, Pa.; Springfield, O.; Council Bluffs, Ia.; Dalton, Pa.; Whatcom, Wash.; Owen Sound, Ont., Canada; Benson, Minn.

Philadelphia, Pa.—The residents of West Philadelphia have permanently organized under the name of Association for the Improvement of the Water Supply of West Philadelphia, for the purpose of securing for that portion of the city west of the Skuylkill river an additional reservoir to provide storage for sufficoent water. Thos. Martindale, president of the association, 413 N. Thirty-third street.

The construction of water works systems is contemplated at the following places: Walsenburg, Col.; Chester, S. C.; Holden, Mass.; South New Berlin, N. Y.; Rangely, Me.; E. J. Herrick, president board of trade, Center Hall, Pa.; C. F. Deringer, president, Durham, N. C.; T. L. Peay, mayor, Huntingdon, Tenn.; Green Spring, O.; Franklin, Tex.; Delta, Col.; San Pedro, Cal.; Chatham, N. B.; St. Lambert, Que.; Dallas City, Ill.; Munising, Mich.

CONTRACTS TO BE LET.

Hiram, O.—Sealed proposals will be received until April 8 for constructing a system of water works; certified check, 5 per cent. B. S. Dean, clerk.

Hico, Tex.—Sealed proposals will be received until April 12, postponed from March 22, for constructing a water works system. J. S. Thacher, Dallas, Tex., engineer.

Kansas City, Mo.—Sealed proposals will be received April 6 for furnishing and erecting at the Turkey Creek pumping station two water tube boilers. R. M. Godfrey, secretary board of public works.

Duluth, Minn.—Sealed proposals will be received until April 9 for 11,060 lineal feet of 36-inch cast iron or steel water pipe with appurtenances; certified check, $8,000. R. Murchison, clerk board of public works.

New Orleans, La.—Sealed proposals will be received until June 1 for the constructions of three pumping stations operated by electricity and three pumping stations operated by steam. R. M. Walmsley, president drainage commission.

CONTRACTS AWARDED.

Lafayette, Ind.—The contract for laying service pipe for the ensuing year was awarded to Wallace Bros.

Adams, Minn.—The lowest bidder for constructing a water works system in this town was Thomas Green of Winona, Minn., at $4,965.

Grenada, Miss.—The contract for constructing a system of water works was awarded March 10 to J. H. Hazelhurst & Co. of Atlanta, Ga.

Plymouth, Ill.—The contract for constructing a system of water works was awarded to the Best Plumbing and Heating Company of Quincy, Ill., for $3,187.

Vulcan, Mich.—The Penn Iron Mining Company has purchased from Henry R. Worthington of New York one of the largest pumping plants ever erected in the Lake Superior iron region at a cost of $15,000.

Elberon, Ia.—The contract for constructing the water works system has been awarded to Jackson & Moss of Des Moines, as follows: Plans and specifications, $3,063; steel tower, $2,997.

Gilman, Ill.—(Special.)—Contracts were awarded March 16 for constructing the water works system as follows: Tower and tank, Ranger & Hobson, Harvey, Ill., $2,901; pump house, chimney and reservoir, Ranger & Hobson, $2,518; pump, feed water heater and feed pump, Chandler, Taylor & Co., Indianapolis, Ind., $1,705; mains, hydrants, etc., Anniston Pipe & Foundry company, Anniston, Ala., $10,068.90. A. D. Thompson, Peoria, Ill., engineer.

BRIDGES.

Yates, N. Y.—A new iron bridge is contemplated over Johnson creek at Yates Center.

Milwaukee, Wis.—A bill has been introduced in the senate for building the Grand avenue viaduct.

Titusville, Pa.—The county commissioners contemplate building a new 180-foot bridge at Brown street.

Worcester, Mass.—Plans are being prepared for a new bridge at the lake by Fred A. McClure, city engineer.

Oroville, Cal.—Bids will be received until April 9 for constructing two bridges across Rock creek, near Nord. County Supervisors.

Northampton, Mass.—A petition is in circulation asking for a bridge over Mill river, from lower Pleasant street to Wright avenue.

Kingston, Tenn.—Plans for a steel bridge across the Clinch river will be made by Geo. Sylvester of Rockville, Tenn.

Port Perry, Pa.—The plans for the proposed new bridge over the Monongahela river have been approved by the War Department.

Urbana, Ill.—The contract will be let April 8 for two highway bridges on masonry. Ira O. Baker, Champaign, Ill., consulting engineer.

Conroe, Tex.—Sealed bids will be received by the Commissioners Court May 10 for the construction of two bridges. Thomas Ballard, commissioner.

Rochester, N. Y.—A bill has ben passed in the legislature appropriating $30,000 for a bridge over the Erie canal at Monroe avenue.

Peckville, Pa.—The stret committee of the Borough Council will draw plans for a new bridge over Sulphur creek on S. Main street.

Danville, Pa.—The viewer's report for a county bridge across the north branch of Mahoning creek has been approved by the grand jury.

Colusa, Cal—Bids are asked until April 8 for constructing a 300-foot bridge at the east end of the Long bridge and Williams road.

Duluth, Minn.—A petition has ben presented by the county board asking for a bridge across the St. Louis river at Byrne crossing.

Anoka, Minn.—A special county election was held April 6 to vote on the proposition of issuing bonds to build a new bridge over Rum river.

Hamilton, O.—The bids for a bridge over the Hydraulic at Black and Clausen streets have ben rejected and new bids will be advertised.

Nashville, Tenn.—The board of public works has approved plans for the proposed bridges at High and Vine streets. J. A. Jewett, city engineer.

Grand Forks, N. D.—Bids will be received until April 6 for constructing bridges during 1897; bond, $100. J. W. Scott, county auditor.

Bement, Ill.—The contract will be let April 9 for a 65-foot highway bridge on masonry. Ira O. Baker, Champaign, Ill., county engineer.

Brooklyn, N. Y.—The Wrought Iron Bridge company, Canton, O., secured the contract for building two steel viaducts in Prospect Park for $7,934.

Goldsboro, N. C.—Bids will be received until April 5 for constructing an iron drawbridge across the Neuse river near this place. County Commissioners.

Greenfield, Mass.—A project is being agitated for the construction of a bridge across the Connecticut river at Mount Herman.

Ilion, N. Y.—The legislature has passed a bill appropriating $18,000 for the construction of a bridge over the Erie canal at Railroad street.

Clarksville, Tenn.—The construction of a county bridge over the Cumberland river at or near this city, is proposed at an estimated cost of $50,000.

Cincinnati, O.—City Engineer Stanley is preparing estimates of the cost of a wagon bridge to replace the foot bridge over Mill creek at Dane street.

Bristol, Tenn.—The question of building an iron bridge over Beaver creek on Main street, between Bristol, Va., and this city, is being considered by the council.

Brainerd, Minn.—The county commissioners are considering the construction of an iron bridge across the Mississippi river to replace the present wooden bridge.

Asbury Park, N. J.—The Wrought Iron Bridge Company, Canton, O., was awarded the contract for building a steel bridge over Yellow Brook in Atlanta township for $1,900.

Brooklyn, N. Y.—The bill providing for the construction of a bridge across Coney Island creek, from W. Eighteenth to W. Seventeenth street, has been signed by the governor.

Dayton, O.—City Civil Engineer Turner has submitted his report upon steel girder bridges for Main and Third streets. The estimated cost ranges from $115,000 to $141,700.

Weldon, N. C.—The Halifax county commissioners contemplate building an iron bridge with stone piers across the Roanoke river, near this city at a cost of about $50,000.

Binghampton, N. Y.—(Special.)—H. Ward says competitive plans and estimates for two bridges across the Shenango river at Ferry and De Forrest streets will be received until April 9.

Richmond, Ind.—The county commissioners have been petitioned to replace the suspension bridge which was washed away during the summer of 1896 with a new one. Alonzo Marshall, county auditor.

Iowa City, Ia.—Sealed proposals will be received until April 9 for iron and steel bridges in length of 100 feet or under during the year 1897; certified check, $300. T. L. Crowley, county auditor.

New Haven, Conn.—The Wrought Iron Bridge company, Canton, O., secured the contract for the superstructure over the new bridge over the railroad tracks on E. Chapel street for $6,177. The contract was awarded March 17.

Albany, N. Y.—Bids are asked until April 6 for an iron bridge superstructure over the Champlain canal, between locks 15 and 16, and a steel bridge superstructure between locks 6 and 7. Geo. W. Aldridge, superintendent public works.

Boonville, Ind.—Bids will be received until April 15 for an iron bridge over Poke Berry creek four miles west of Dale. Bids will be received April 16 for an iron bridge over

Otter creek, three miles northeast of this city; all bidders to furnish their own plans and specifications. T. P. Tillman, auditor.

Muscatine, Ia.—Bids are asked until April 7 for constructing 165-foot iron and steel wagon bridge over Cedar river Tice's ferry; also, for constructing iron bridges in Muscatine county for one year. E. C. Stucker, county auditor.

Springfield, O.—Sealed proposals will be received until April 19 for constructing the foundation and abutments for a bridge over Buck creek in Snyder park; also limestone and sandstone; certified check, $1,000. Samuel G. Wilkerson, city clerk.

Chattanooga, Tenn.—Plans have been completed for a new bridge over Sale creek on the Washington road. The plans are for a 72-foot steel span and a 90-foot iron trestle with a 16-foot roadway. Estimated cost, $2,000. County Engineer Betts.

STREET CLEANING AND SPRINKLING.

Reading, Pa.—The construction of a garbage disposal plant at a cost of $13,900 is under consideration. Councilman Boas.

Montclair, N. J.—The town council has under consideration a proposition to put in a Smith-Vivartas garbage disposal plant.

Youngstown, O.—A proposition to put in a garbage disposal plant at a cost of about $8,000 has been made to the council by M. K. Stringfellow of Findlay, O.

Chicago, Ill.—The contract for cleaning the streets for the year, beginning March 22, was awarded to John S. Cooper at $10.80 per mile for the entire city.

Indianapolis, Ind.—Bids were received March 15 for street sprinkling in the different districts. The bids show a saving of about $9,000 on the entire city. The contract was awarded only for the capitol avenue district, from Indiana avenue to Twenty-first street, which was awarded to Fuehring Bros. at $29 for each 10,000 square feet, from March 15 to Dec. 15, 1897.

St. Paul, Minn.—Street sprinkling contracts were awarded Feb. 23 as follows: First district, Thomas Reilly, 18⅝ cents per week for each 100 feet of street. Second district, Nicholas Feyen, 19 19-100 cents per 100 feet. Third district, Fielding & Shepley, 17⅛ cents. Fourth district, Nicholas Feyen, 18 18-100 cents, except asphalt pavement, which was let to Fielding & Shepley at 27 48-100 cents per 100 feet. Fifth district, Nicholts Feyen, 17 85-100 cents. Sixth district, Nicholas Feyen, 19 46-100 cents. Seventh district, William J. Preston, 19½ cents, except asphalt, which was let to Feyen at 49 cents. Eighth district, action postponed, as Preston and Reilly made like figures. Ninth district, George N. Warren, 24 cents.

PARKS.

Newport, R. I.—The Park Commission has adopted plans prepared by Olmstead, Olmstead & Elliott.

Albany, N. Y.—Estimates for completing the Beaver Park will be submitted April 12 by the superintendent of parks.

Scranton, Pa.—An expenditure of about $200,000 is contemplated for securing a more adequate park system this year.

St. Paul, Minn.—A bill has been introduced by Representative Anderson appropriating money for extending and improving the Interstate Park. George H. Hazzard, commissioner.

Allegheny, Pa.—It is probable that work will begin this spring on a park and zoological garden at the Riverview park. Estimated cost, $300,000. William Hamilton, superintendent of parks.

Buffalo, N. Y.—The park commissioners have asked for $600,000 for park improvements. The issue of long term bonds for $475,000 is favored for meeting part of the expenditure.

Cleveland, O.—It is probable that the park board will not construct an easterly entrance to Edgewater park as long as public opinion is unfavorable toward it.

Newark, N. J.—The Essex County Park Commission decided, March 18, upon the purchase of additional tracts of land for the Branch Brook, the West Newark, and the Lake Weequahic or Waverly Parks.

Los Angeles, Cal.—The board of park commissioners, on March 4, approved the plans for the improvement of Elysian Park. The highest elevation in the park was christened Mount McKinley.

New Castle, Pa.—An offer of 60 acres of lands for park purposes has been made by some well known citizens on the condition that the city will expend $10,000 within the next five years in improving the land.

Chicago, Ill.—The Lincoln Park Commissioners accepted the ordinance, March 9, for boulevarding Pine street, from Chicago avenue to Ohio street, which will make a continuation of five blocks of the lake shore drive from the water works south.

Orange, N. J.—Wm. S. Macy of this city presented the Essex County Park Commissioners with a check for $15,000 March 1 in behalf of the citizens in appreciation of the action of the commissioners in locating a park site in this city.

St. Louis, Mo.—The citizens residing in the vicinity of Gravois Park have made a petition to the board of public improvements for its improvement. The park was almost destroyed by the tornado in the summer of 1896 and has never been repaired.

Philadelphia, Pa.—The plans for the improvement of the Thirty-fourth street entrance to the park at Girard avenue were opposed March 11 and specifications were ordered prepared for widening the East River drive. The sum of $54,000 has been appropriated for this purpose.

Woburn, Mass.—The park commissioners, in their report for 1896, indorse a liberal appropriation for securing land in different parts of the city for either parks or playgrounds. A loan for park purposes is recommended, and, if provided, the park will be laid out by a landscape architect.

New Haven, Conn.—Hon. Henry F. Blake, Capt. Charles H. Townsend, Alderman Chillingworth and Corporation Counsel Ely appeared before the committee on incorporations March 4, in behalf of the bill providing that by favorable vote of the citizens the trustees of the old town farm may turn over the annual income of the old town farm funds to the park commissioners to be used in the line of improvement of the public parks of this city.

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